HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL AIR CONDITIONING, REFRIGERATION, AIR SANITATION, PIPING, HEATING AND VENTILATION

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Associate Editor
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Advertising Representatives

Eastern Representatives
DWIGHT COOK
HARRY J. TWINE
148 Lafayette Street
New York 13, N. Y.

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GEORGE G. TURNER
228 North La Salle Street
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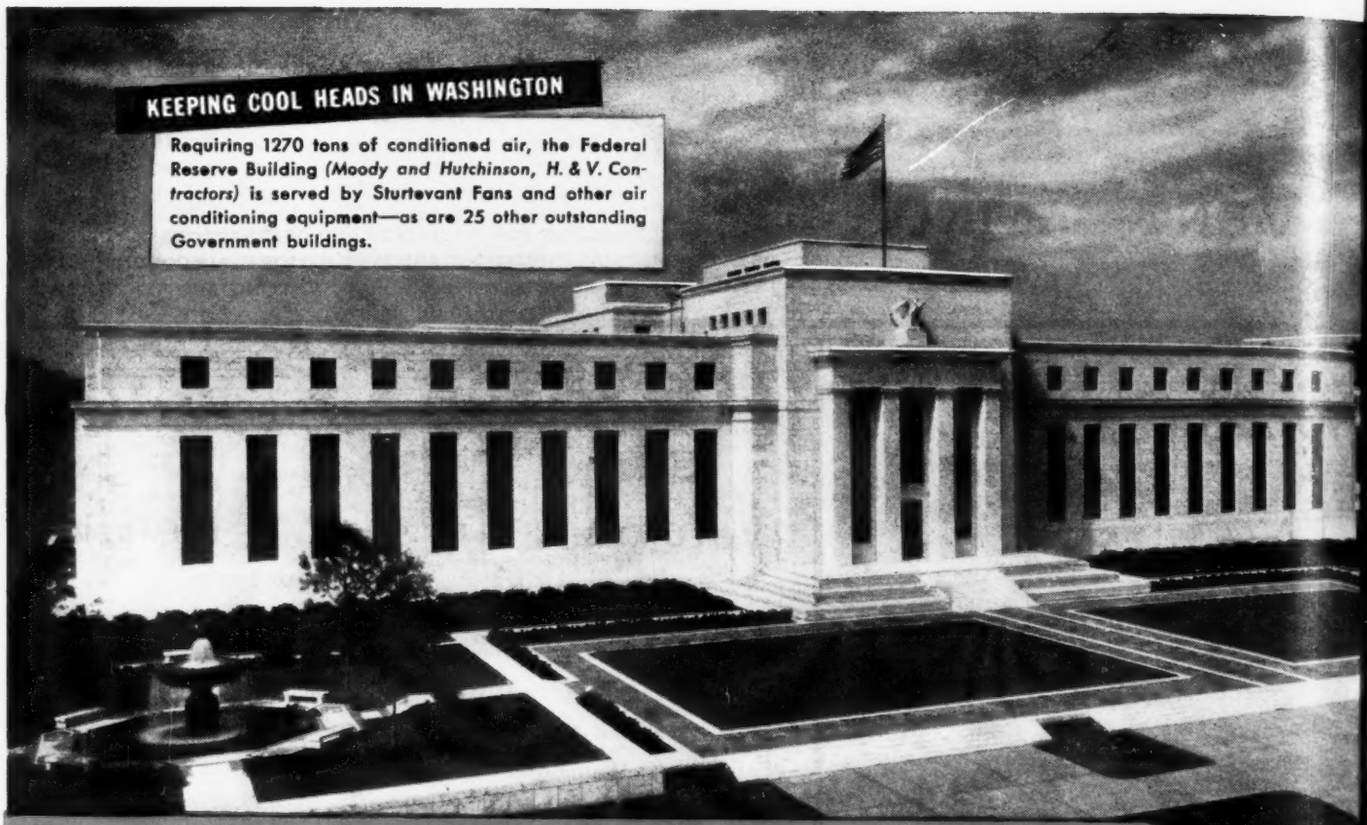
THIS MONTH'S COVER

The photograph, courtesy of the U. S. Maritime Commission, is to direct attention to National Maritime Day, and to the article by John W. Markert on air conditioning the post-war merchant fleet.



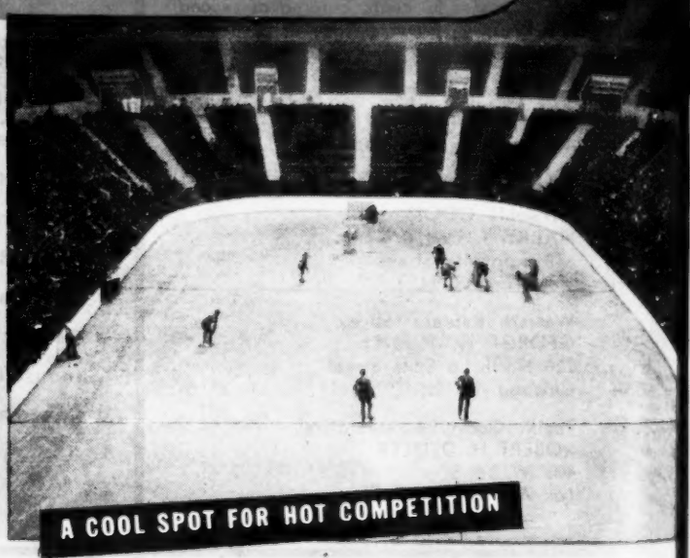
KEEPING COOL HEADS IN WASHINGTON

Requiring 1270 tons of conditioned air, the Federal Reserve Building *(Moody and Hutchinson, H. & V. Contractors)* is served by Sturtevant Fans and other air conditioning equipment—as are 25 other outstanding Government buildings.

Can you use this kind of PUBLIC BUILDING Experience?

GRANDDADDY OF AIR CONDITIONING

Sturtevant Equipment serves the modern Eastman Casino in Chicago's Congress Hotel, just as it does the adjacent Pompeian Room—first commercially engineered complete comfort-air-conditioning system—it was engineered and installed by Sturtevant *34 years ago!*

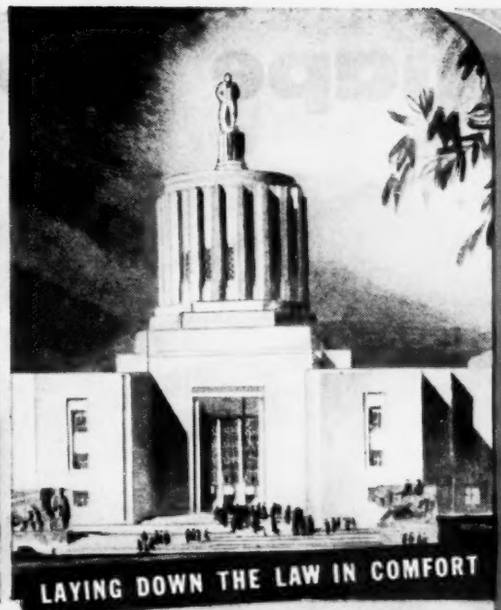


A COOL SPOT FOR HOT COMPETITION

Heating and Ventilating in the famous Hershey Arena is handled by Sturtevant Heating Units for entrances, corridors, and offices, Exhaust Fans for team and shower rooms, and general exhaust housed in special roof dormers. *Hershey Lumber Products Co., Engineer & Contractor.*

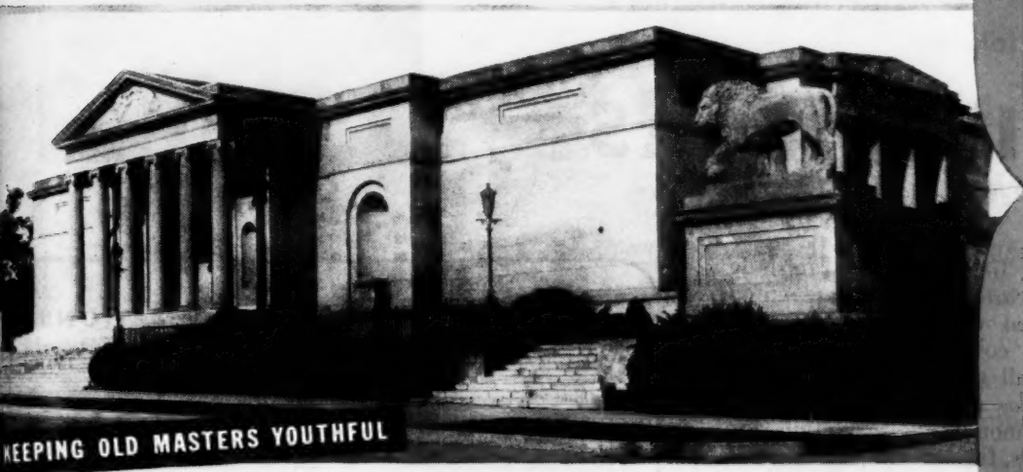
SETTING A POLICY OF COMFORT

Seven air conditioning systems in New England Mutual Life Home Office Building, utilize Sturtevant Fans, Dehumidifiers and Heating Coils—plus 581 Sturtevant Air Blenders. Engineered and installed by *Buerkel & Co., Inc.*



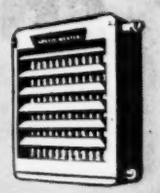
LAYING DOWN THE LAW IN COMFORT

Ventilating Systems which supply air at 70° F to Legislative Chambers and a variety of rooms and offices, utilizes 12 large capacity Sturtevant Supply and Exhaust Fans. *Lord and Loryea, H. & V. Contractors.*



KEEPING OLD MASTERS YOUTHFUL

Sturtevant Equipment for heating and air conditioning at the Baltimore Museum includes Silentvane Fans, Unit Ventilators, Unit Heaters, Vent Sets, Air Washers and Coils. *H. E. Crooks Co., H. & V. Contractors.*



SPEED HEATERS

SILENTVANE DESIGN 788

AIR WASHERS

HEATING AND COOLING COILS

STURTEVANT UNIT VENTILATORS

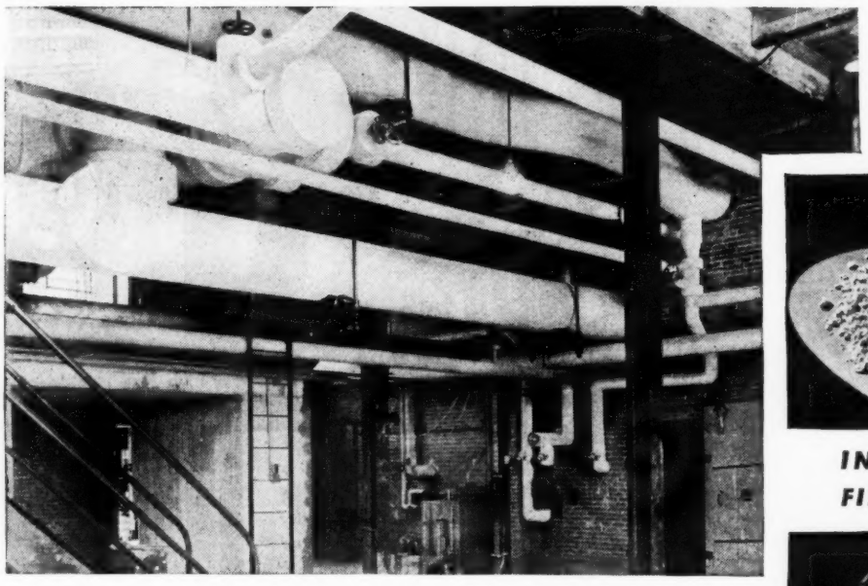
STURTEVANT AIR BLENDERS

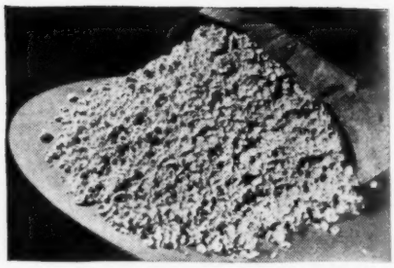
Over two billion for public buildings . . . almost one billion for commercial buildings! It's the picture—of plans started or completed—for America's non-residential Building Program. That means plenty of work for you. And plenty of the kind of dependable heating, ventilating and air conditioning apparatus that Sturtevant Experience assures. Experience in equipping most of the country's outstanding public buildings. Your competition is keen. It calls for cooperation to help figure the job closely—careful engineering to keep down the cost and guarantee a satisfactory installation. That's where Sturtevant is ready to work closely with you—in designing, laying out and estimating. And this cooperation really clicks—as engineers and contractors we are working with will testify.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

★"shipshape" appearance





INSULATING AND FINISHING CEMENT

...another job for

FIBERGLAS*→

In co-operation with the Government program to save critical fuel.

Fiberglas Insulating and Finishing Cements are excellent companion items used with Fiberglas Insulations in covering pipes, boilers, retorts—all sorts of heated vessels.

Fiberglas Insulating Cement provides a monolithic insulation for pipe bends, fittings, irregular shaped vessels. It combines excellent thermal insulating value with ease of application. This material can be used over steel, brick and insulation blocks and metal mesh blankets. When located outdoors or exposed to moisture or abrasion a protective jacket or a coating of OC Mastic finish should be applied to protect the cement. *Fiberglas Insulating Cement* is made of modulated Fiberglas Insulation, dry-mixed with refractory-type materials. It is reclaimable up to 1000° F., has low shrinkage and provides an excellent base for Fiberglas Finishing Cement or OC Mastic finish.

Fiberglas Finishing Cement provides a smooth, attractively finished exterior surface when properly applied over the Fiberglas Insulating Cement base. Made of a combination of light-density Fiberglas and suitable binders, it is easy to mix and may be used as a scratch coat, finish coat or both.

There is a form of Fiberglas Insulation Material to meet virtually every industrial need—in the power plant and out through service and process lines. If you do not have complete information on the materials listed in the panel at the right, write today for "Fiberglas Insulations for Industry" . . . *Owens-Corning Fiberglas Corp., 1841 Nicholas Bldg., Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

FIBERGLAS INDUSTRIAL INSULATIONS

1. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3" O.D. Will withstand temperatures up to 1000° F.

2. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6" x 36" and 12" x 36", standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3" x 18" and 6" x 36" and 12" x 36"—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

8. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24" x 48", 1" to 4" in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

9. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with incombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24" x 48". Thicknesses from $\frac{3}{16}$" to 2".

ARMY E NAVY

FIBERGLAS

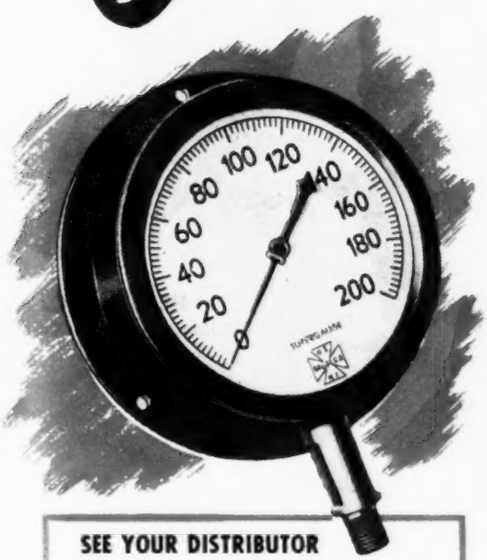
*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS

When it's time to buy more

REMEMBER IT'S U. S.

6 to 4!



SEE YOUR DISTRIBUTOR

Insist on U. S. Gauges and get the best. Accept no substitute when you specify them on the next order to your supply house.

Always Insist on U. S. Gauges—the Choice of 6 Out of 10 Original Equipment Manufacturers

YOU DON'T have to look very far in any industry before you're convinced that U. S. Gauges stand out above all other makes on all types of equipment.

The reason is logical. Over 6 out of 10 manufacturers install U. S. Pressure and Vacuum Gauges on their original equipment. Experience has proved that ever-accurate, reliable U. S. Gauges definitely contribute to better product performance. That's why manufacturers have standardized on the quality-controlled gauges that *tell the truth.*

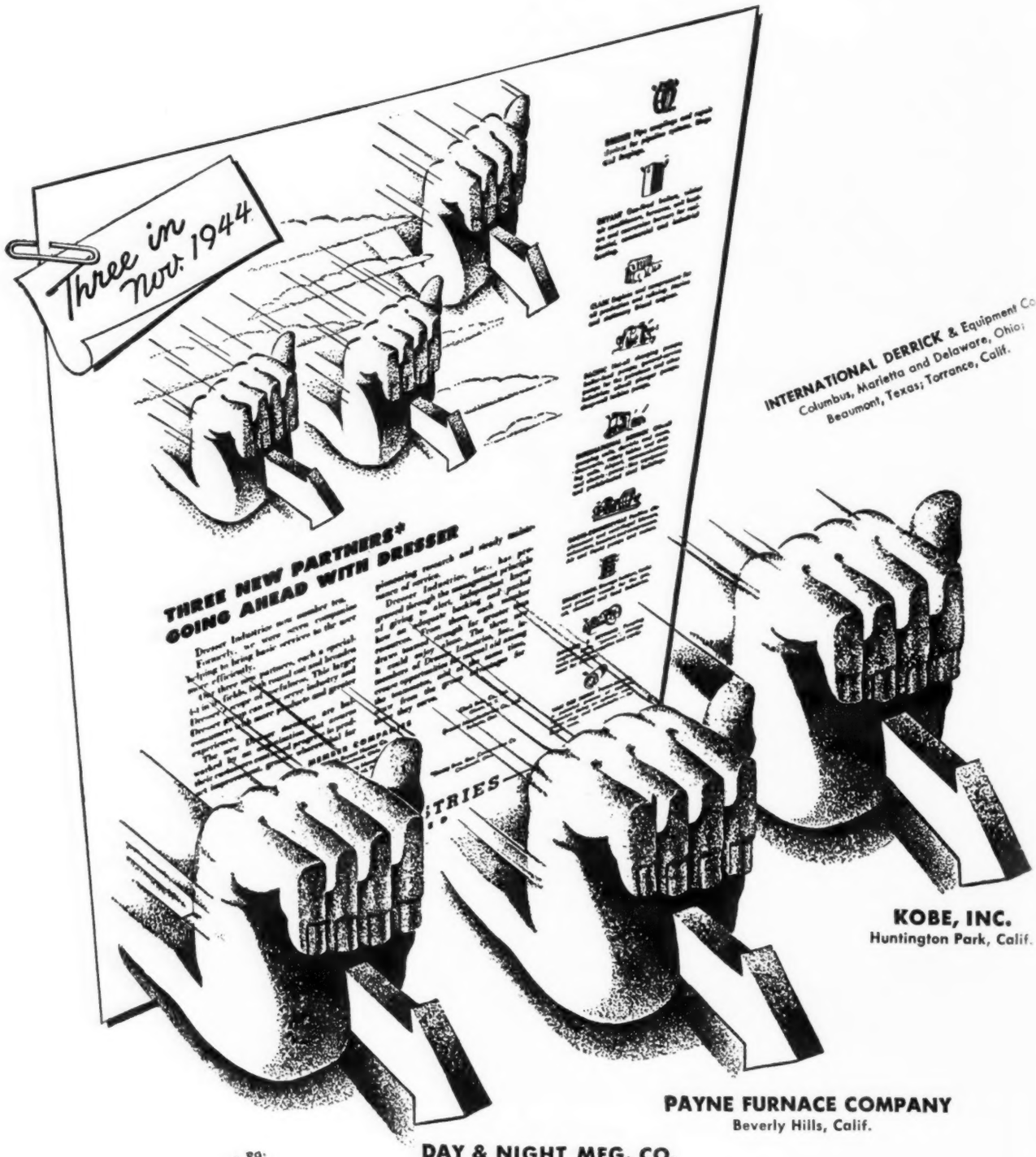
There is no finer endorsement of any gauge than this continued acceptance by the "men who know". Next time you need gauges, be sure to specify U. S. Gauges, the *right* gauges in the majority opinion of experts.

UNITED STATES GAUGE COMPANY, SELLERSVILLE, PA.

U. S. Instruments Tell the Truth

USG UNITED STATES GAUGE

Manufacturers of Pressure, Temperature, Flow, Electrical and Level Measuring Instruments



INTERNATIONAL DERRICK & Equipment Co.
Columbus, Marietta and Delaware, Ohio;
Beaumont, Texas; Torrance, Calif.

KOBE, INC.
Huntington Park, Calif.

PAYNE FURNACE COMPANY
Beverly Hills, Calif.

DAY & NIGHT MFG. CO.
Monrovia, Calif.

DRESSER Mfg. Division, Bradford, Pa.

BRYANT Heater Company, Cleveland, Ohio

CLARK Bros. Co., Inc., Olean, N. Y.

PACIFIC Pumps, Inc., Huntington Park, Calif.

...again three more

BECOME PARTNERS IN

DRESSER INDUSTRIES, INC.

ROOTS-CONNERSVILLE Blower Corp.,
Connersville, Ind.

STACEY BROS. Gas Construction Co.,
Cincinnati, Ohio

BOVAIRD & SEYFANG Mfg. Company
Bradford, Pa.

DRESSER Manufacturing Co., Ltd.,
Toronto, Ont., Canada

VAN DER HORST Corp. of America,
Olean, N. Y. and Cleveland, Ohio

Dresser Industries continues its growth toward more efficient, more comprehensive service to customers. Three new partners now enlarge our scope of usefulness to the gas and oil industries.

Day & Night Manufacturing Co., supplies a remarkably efficient hot water heater for the home. Payne Furnace Company is unexcelled, particularly throughout the West, for its gas-fired steel heating equipment. These two companies perfectly complement and augment Bryant Heater Company, a Dresser Industries member which for 35 years has produced fully automatic, quality gas-fired heating appliances, most extensively used in the East.

Kobe, Inc., makes an ingenious hydraulically actuated oil-well pump, a fundamental development in view of the nation's need to go ever deeper for oil. This pump dovetails with oil-well drilling and production equipment offered by two other Dresser Industries members, Pacific Pumps, Inc., and International Derrick & Equipment Company.

Dresser Industries is now a team of thirteen companies pooling their resources for better products, better service to their customers.

Dresser Industries, Inc.
Terminal Tower, Cleveland 13, Ohio

Let us share your troubles!

Perhaps we're a little ahead of time in making this offer. But we are so anxious to resume our old custom of working with the heating contractor that we have decided to stick our necks out again and see what happens.

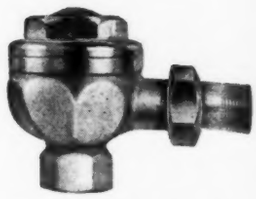
Now that our war production has entered a more routine phase, Marsh Representatives *do* have more time released for cooperating with you. So do not hesitate to call on us when you run into trouble.

A complete knowledge of heat distribution systems is the first requisite of success in designing and manufacturing heating specialties. By their very nature Marsh valves, traps, venting devices and gauges function to take the bugs out of heating systems. So, naturally, in applying Marsh equipment, we have had a lot of insight into the troubles that develop and the ways of correcting them.

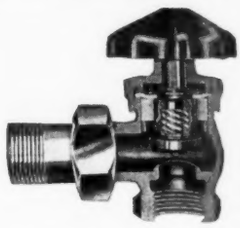
A few Marsh products are illustrated opposite—products that have a proved record in making heating systems click. But when you think of Marsh remember that it is more than the name of an excellent product. It is also the name of an organization that is always ready to work with you.

Write for the name of our nearest heating engineer

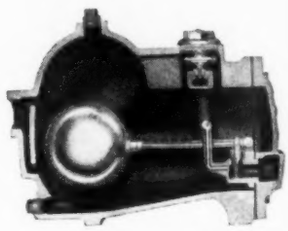
JAS. P. MARSH CORPORATION, 2089 Southport Ave., Chicago 14, Illinois



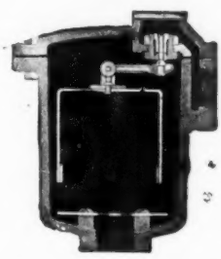
Marsh Thermostatic Diaphragm Radiator Trap. Its seamless, sensitive, powerfull bellows is the secret of its excellent performance.



Marsh Packless Radiator Valve. The unique Marsh metal-to-metal seal makes it *truly* packless.

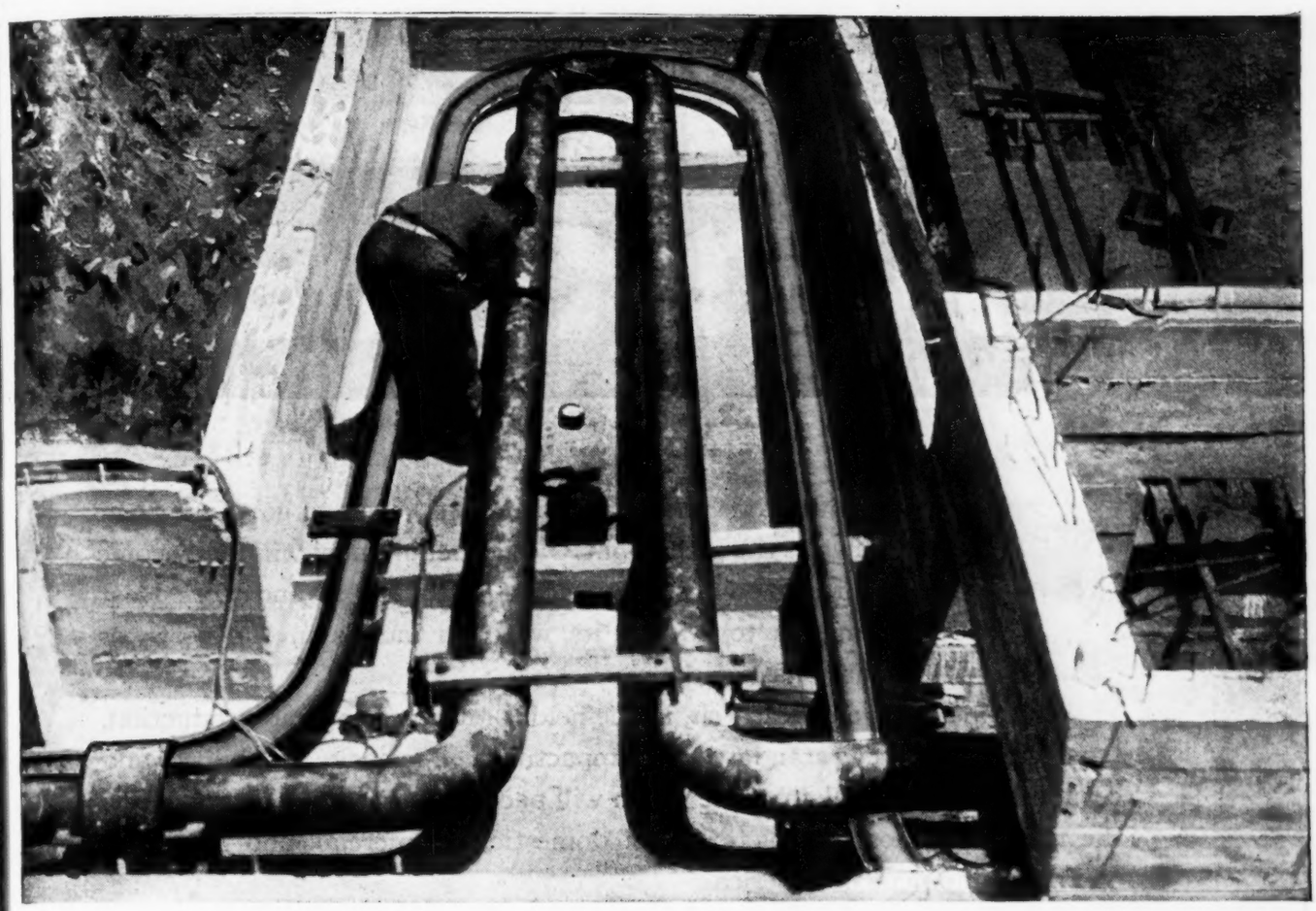


Marsh Heavy Duty Float and Thermostatic Trap. Typical of a broad line of traps of this type.



Marsh Inverted Bucket Trap. The inverted bucket type at its best.

MARSH *Quality Heating Specialties* SINCE 1865



The Trend Toward Permanence

EMPHASIZES THE ECONOMY OF LONG-LIFE MATERIALS

Illustration shows expansion joint for heating lines laid in 8,800 feet of concrete conduit at the University of Connecticut, Storrs, Conn. Condensate return lines, subject to the corrosive action of the boiler water, are of Anaconda Red Brass Pipe welded with Tobin Bronze*. Sixty thousand pounds of Red Brass Pipe, from 1½" to 6" S.P.S., were furnished by Crane Co., New Haven, who made the bends for the expansion loops.

Consulting architects and engineers to the State of Connecticut, Westcott and Mapes, Inc., New Haven. Contractor, C. N. Flagg & Co., Inc., Meriden. All welded joints were supervised and approved by Hartford Steam Boiler Inspection and Insurance Company. *Reg. U. S. Pat. Off.

MORE AND MORE, civic and industrial planning inclines toward the long range viewpoint. Permanent construction—using quality materials—gains in favor over the practice of building for immediate needs only. This type of planning emphasizes the economy of using long-life Anaconda Copper Tubes and Red Brass Pipe to resist corrosive conditions in air conditioning, heating, plumbing and industrial piping installations.

Experience over the past few decades stresses the dependability and durability of copper and brass in these applications. The extension of chemical treatment of domestic waters further increases the need for these non-rust materials.

Anaconda Copper Tubes and Red Brass Pipe are furnished in a standard range of sizes and wall thicknesses and allow the architect or engineer a choice of threaded fittings, solder-type connections or welded assemblies. 4571

ANACONDA
from mine to consumer

Buy War Bonds
Buy more
. . . HOLD ALL

Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: Anaconda American Brass Ltd., *New Toronto, Ont.*

YORK-HEAT

With plans, plant, and personnel ready to go, York-Heat awaits the green light. Oil-fired equipment will really come into its own, when peace is restored . . . and York-Heat intends to add to its war-won laurels in the post-war national market.

War experience and research, in the fields of engineering and production, have created a new standard of compactness, efficiency, reliability, and economical operation in the line which will pace the industry . . . York-Heat, the finest and most complete line of domestic, commercial, and industrial oil-fired equipment in America!

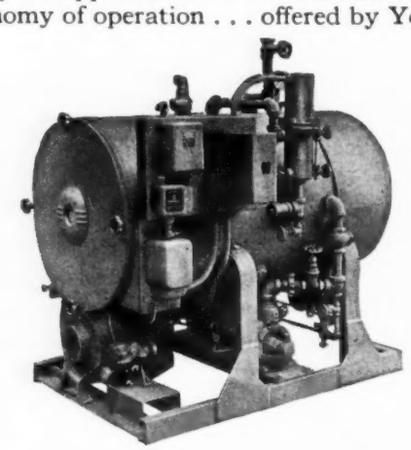
YORK-HEAT

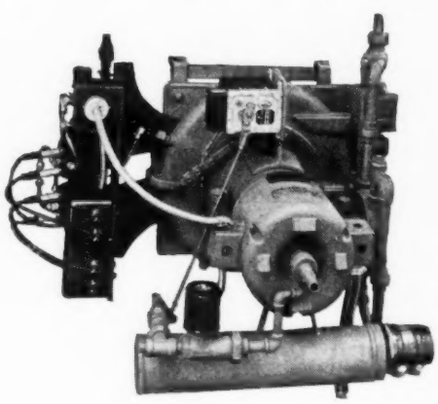
OIL-FIRED EQUIPMENT FOR INDUSTRY

York-Heat industrial equipment covers the complete range of industrial installations, in capacities of 4 H.P. up to 250 H.P. Wartime experience in design and production is reflected in greatly stepped-up efficiency and dependability . . . and in scaled down size (up to 40 per cent).

Post-war industry will turn to the flexibility of application . . . the outstanding economy of operation . . . offered by York-Heat Horizontal Rotary Oil Burners and Industrial Boiler-Burner Units. Exclusive patented features, like the Iris Shutter and the Flame Former, perfectly adapt York-Heat to every industrial heating and steam-generating need.

Desirable territories are still open to men with industrial experience. Ask us about a York-Heat distributor-franchise in your locality.

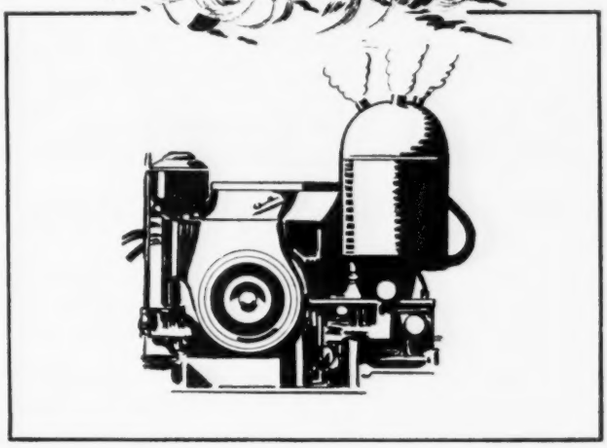




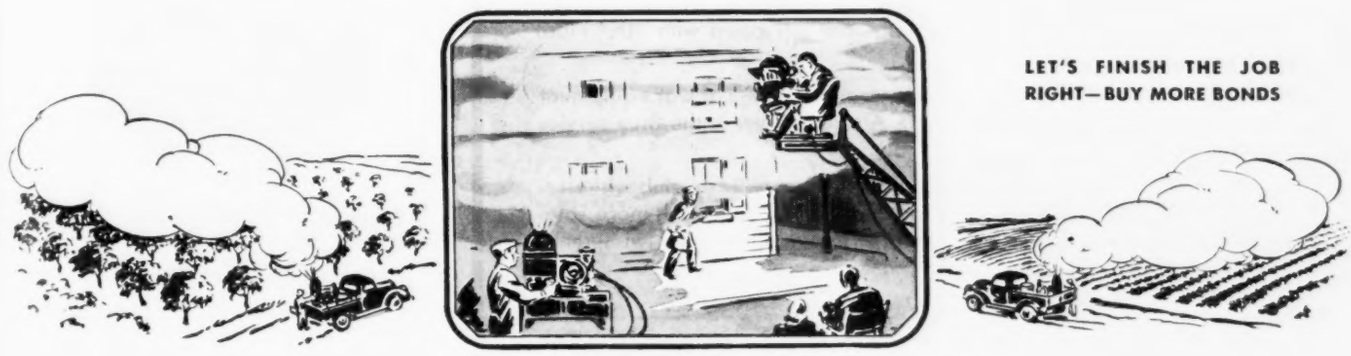
BLANKETS THE MARKET

This, too, is York-Heat!

TODAY... The Fog (smoke-screen) Generator . . . remarkable war-time development of York-Heat . . . weighs only one-tenth as much as machines formerly used to do the same job. It is operated by one man . . . vaporizes 100 gallons of oil per hour . . . and can blanket a square mile of combat-area with dense fog, in five minutes.



TOMORROW... This military application of York-Heat shows promise of many novel and important uses in the post-war era, especially in truck farming, fruit growing, and motion picture production. This is no mere accident. York-Heat planned it that way.



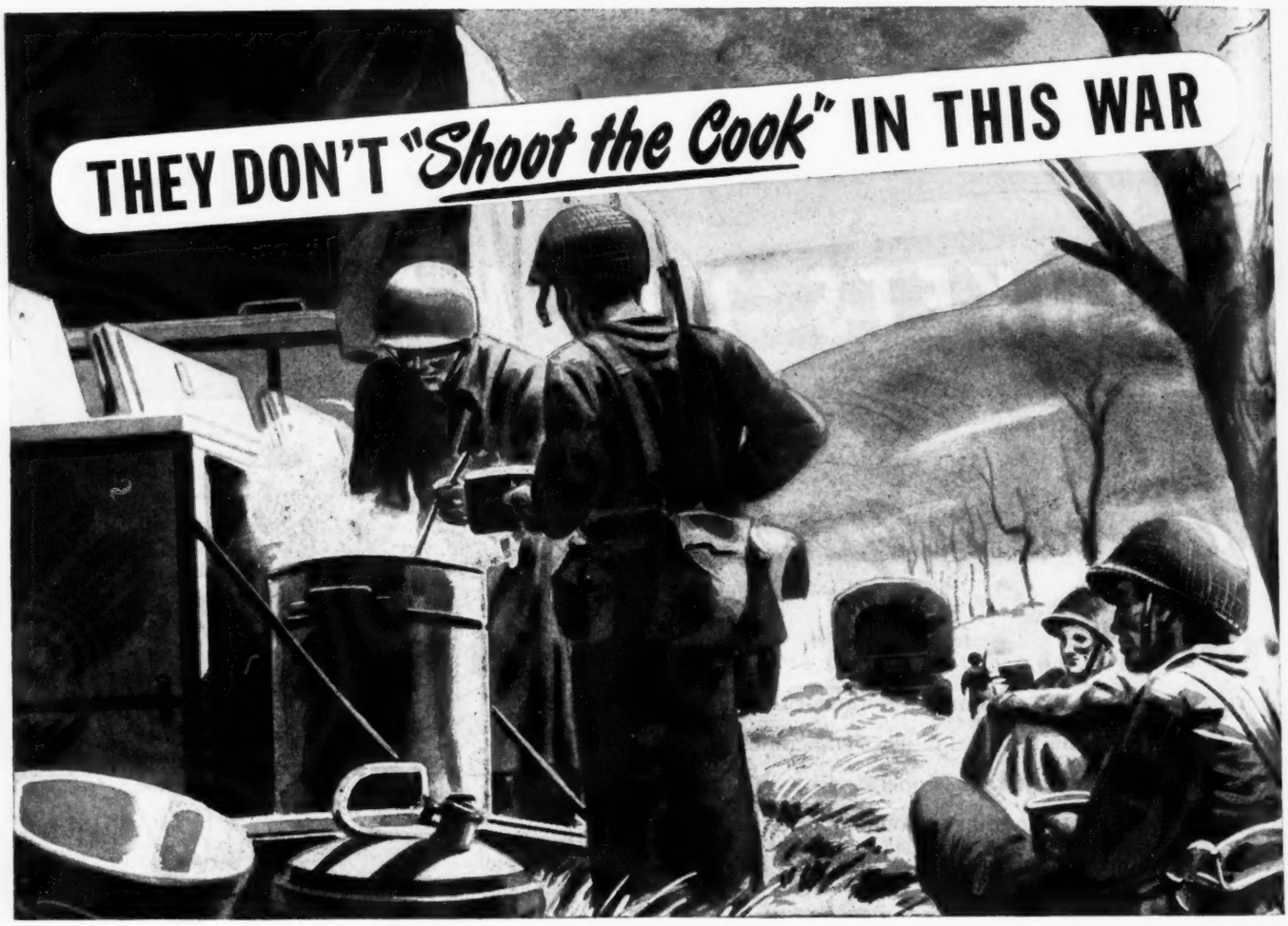
LET'S FINISH THE JOB RIGHT—BUY MORE BONDS

YORK-HEAT

Division of YORK-SHIPLEY, INC., YORK, PA.

Member Oil Heat Institute of America

DOMESTIC ★ COMMERCIAL ★ INDUSTRIAL OIL-FIRED EQUIPMENT



"DL" Float Valves Help Protect Rolling Field Kitchens

In the last war, someone was always shooting the cook—just about dinner time. The smoke from coal or wood-fired rolling kitchens made a fine target for enemy artillery and bombers.

Our army field kitchens are now fired by gasoline or oil. There is no telltale smoke to reveal the location of the kitchen and the mealtime concentrations of men. Meals can be cooked after nightfall because the kitchens do not glow.

Thousands of these field ranges, tent heaters, water heaters and furnaces—wherever our men are fighting—are equipped with "DL" Float Valves.

"DL" Float Valves are in demand by manufacturers of war equipment because of their simplicity of design. A screw driver is the only service tool needed.

When our soldiers return, thousands of them will remember the reliable service rendered by "DL" Float Valves, making much more saleable the postwar stoves, furnaces and heaters equipped with these valves.

An Important "DL" FLOAT VALVE FEATURE

AUTOMATIC TEMPERATURE COMPENSATION

Fuel oil viscosity increases as temperature drops. To avoid underfeeding when oil is cold—overfeeding when warm, the "DL" Float Valve has a simple temperature compensation which automatically maintains constant fuel delivery regardless of temperature.

DETROIT LUBRICATOR COMPANY

General Offices: DETROIT 8, MICHIGAN

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

Canadian Representatives: Railway and Engineering Specialties Limited, Montreal, Toronto, Winnipeg

"DL" Heating and Refrigeration Controls • Engine Safety Controls • Safety Float Valves and Oil Burner Accessories • "Detroit" Expansion Valves and Refrigeration Accessories • Stationary and Locomotive Lubricators

The Proper Equipment . . . CORRECTLY APPLIED

An example of a Johnson *Summer-Winter* Thermostat and Humidostat for year-'round Individual Room Control.

On the Job—to *Do* the Job

Look at the heating and air conditioning system in any building—residential, commercial, public, institutional, industrial. Each installation presents an individual problem, calling for the best specialized knowledge. Manufacturing fine automatic temperature control equipment is not enough—*correct application* is also necessary. That is why there are Johnson engineers in every large city.

Johnson men . . . everywhere . . . cooperate with architects, consulting engineers, contractors, and owners. Years of training and experience enable them to bring expert knowledge to bear on the proper application of every element in the complete control system.

Their obligation does not end with manufacturing and selling the *best* in automatic temperature control equipment. That is why they are called upon, time and again, to aid in solving temperature control problems for the same people. On *your* next temperature control problem, ask your heating and air conditioning engineer or contractor about Johnson . . . or call a Johnson engineer from a nearby branch.

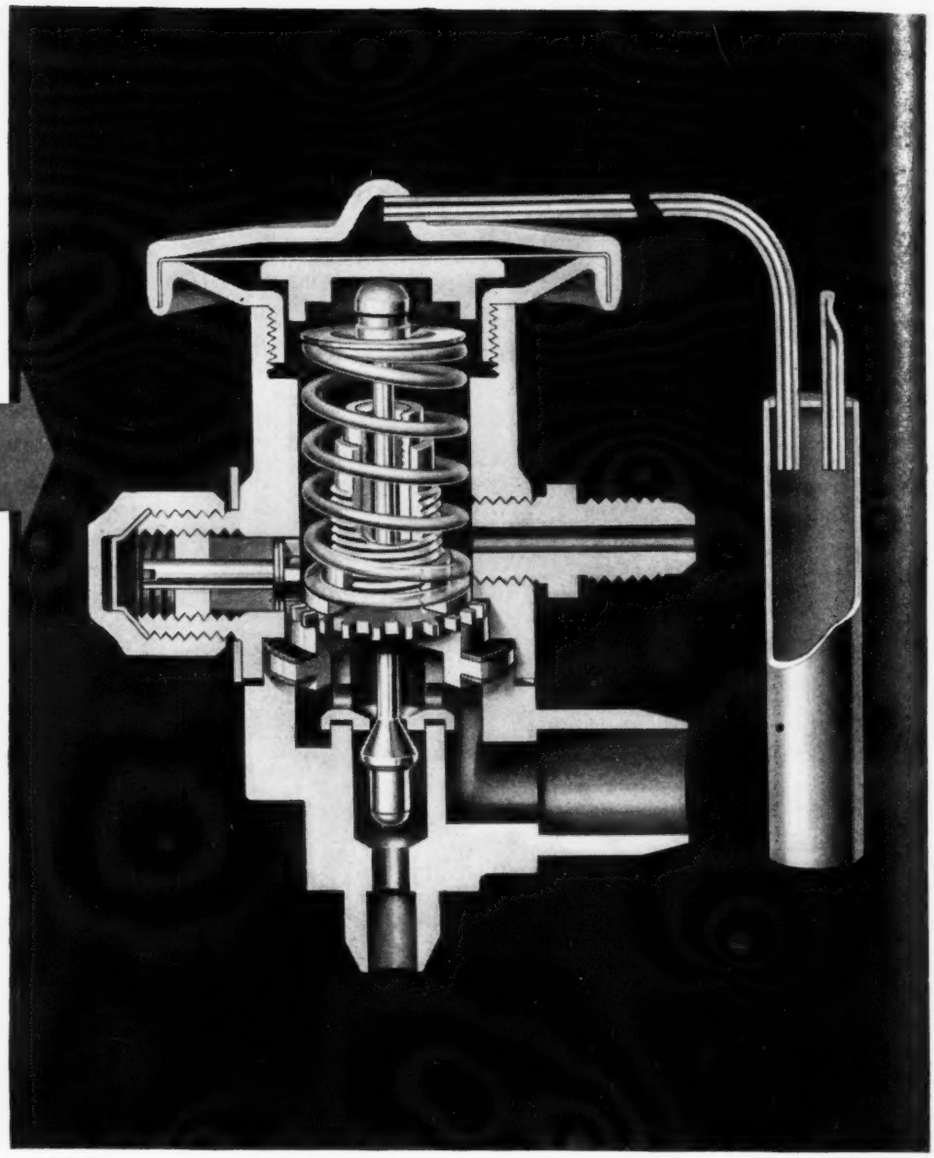
DESIGN
MANUFACTURE
INSTALLATION
SERVICE

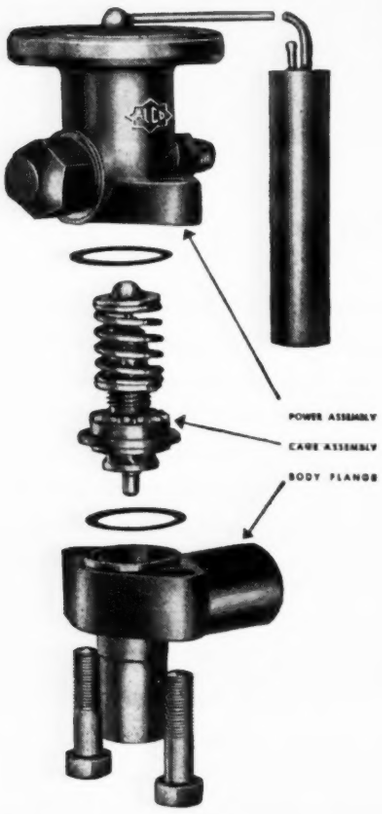
JOHNSON
SERVICE COMPANY
MILWAUKEE 2, WISCONSIN
AUTOMATIC TEMPERATURE AND AIR CONDITIONING CONTROL

Now You Can

SEE

The Advantages of an Alco Thermo Valve





Here is a refrigerant flow control that is *engineered* for operating efficiency. Look at its simple construction—no multiple diaphragms or springs to cause excessive friction. Only three major units—power assembly, cage assembly and body flange. All working parts contained in easily removable cage assembly. Valve need not be taken from line for servicing. This simple, unit-type construction is your best assurance of low operating costs and greater refrigeration efficiency. See your Alco Jobber. Alco Valve Company, 859 Kingsland, St. Louis 5, Mo.

ALCO VALVE COMPANY

Designers and manufacturers of Thermostatic Expansion Valves; Pressure Regulating Valves; Solenoid Valves; Float Switches; Float Valves.

859 Kingsland Avenue • St. Louis, 5, Mo.

TITUSVILLE

SCOTCH MARINE POWER BOILERS

Designed for Oil or Gas (fully-automatic or manual control), and for Coal (stoker or hand-firing).

The results of more than fifty years of boiler manufacturing progress,—with dependability and efficiency even more completely established in *war service*. Ideal for hundreds of industrial and marine applications where constant, uninterrupted power and steam supply are required.

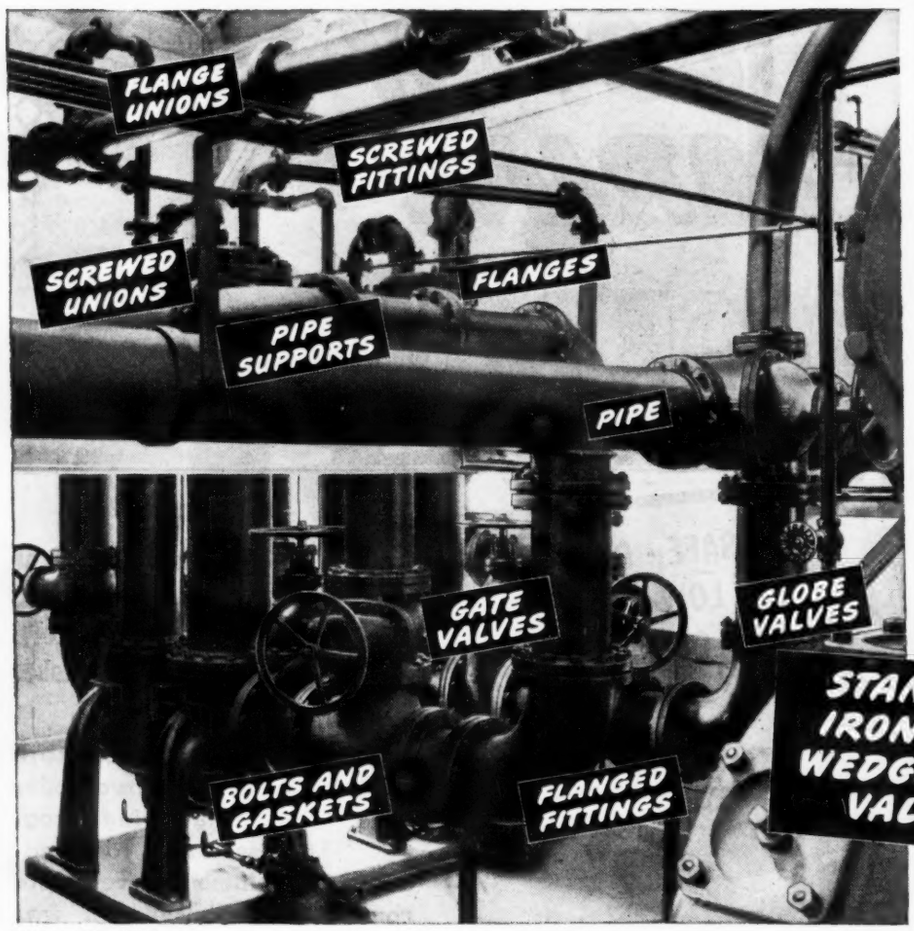
TITUSVILLE engineers with their wide experience, will be glad to cooperate in designing and building Boilers to fit your specific requirements. Descriptive Bulletins on request.

STRUTHERS WELLS CORPORATION
TITUSVILLE BOILER DIVISION
TITUSVILLE, PENNSYLVANIA
Plants at TITUSVILLE, PA. AND WARREN, PA.

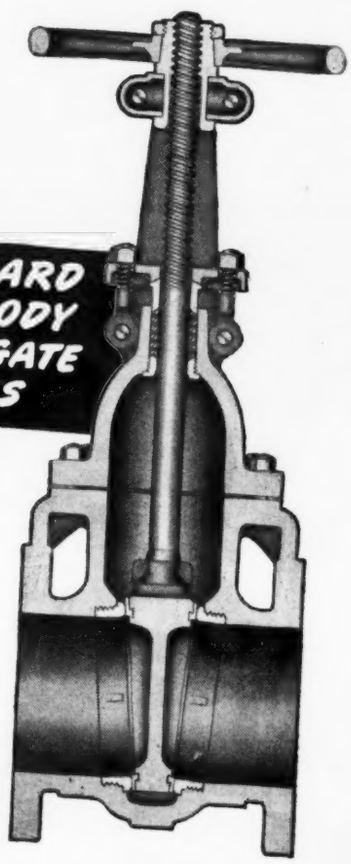
CRANE CAN SUPPLY IT
. . . Whatever You Need in Piping Materials

ONE SOURCE OF SUPPLY
ONE RESPONSIBILITY FOR ALL PARTS
ONE STANDARD OF QUALITY

It's easy to simplify and speed deferred replacement work . . . when you take advantage of Crane *complete* piping materials service. *All* your piping needs are supplied by a single source—your Crane Branch or Wholesaler. You get exactly what you need—you choose from the world's greatest line of piping materials, in brass, iron and steel. Uniform quality in all parts—and one responsibility for them—helps you get the best installations. Crane Co.'s 90 years' experience in meeting piping needs assures your complete satisfaction. In Standard Iron Body Wedge Gate Valves, for example, Crane offers the complete line listed below.



Aftercooler hook-up



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** with Brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S. & Y. and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • *Branches and Wholesalers Serving All Industrial Areas*

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

threads of destiny

THE destiny of an American life or a battle won may depend on the accuracy and reliability of a circle Ⓑ fastener. Our inspectors think of this constantly when they check tolerances and quality.

BUFFALO BOLT COMPANY

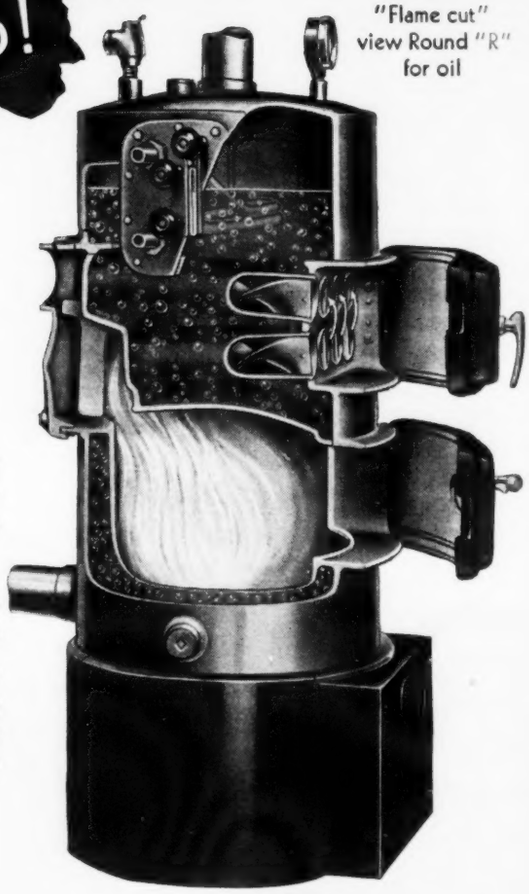
NORTH TONAWANDA, NEW YORK

SALES OFFICES IN PRINCIPAL CITIES

A few of the machines which give circle Ⓑ bolts their accurate threads.

Easy to look at . . .
Easy on Fuel Bills too!

"Flame cut" view Round "R" for oil



KEWANEE
ROUND "R" STEEL BOILER

One look at the Kewanee Round "R" in its trim insulating jacket will prove its attractiveness. BUT, even more important, a look inside that jacket *shows a healthy heart of steel* which provides extra years of service . . . and saves fuel every year.

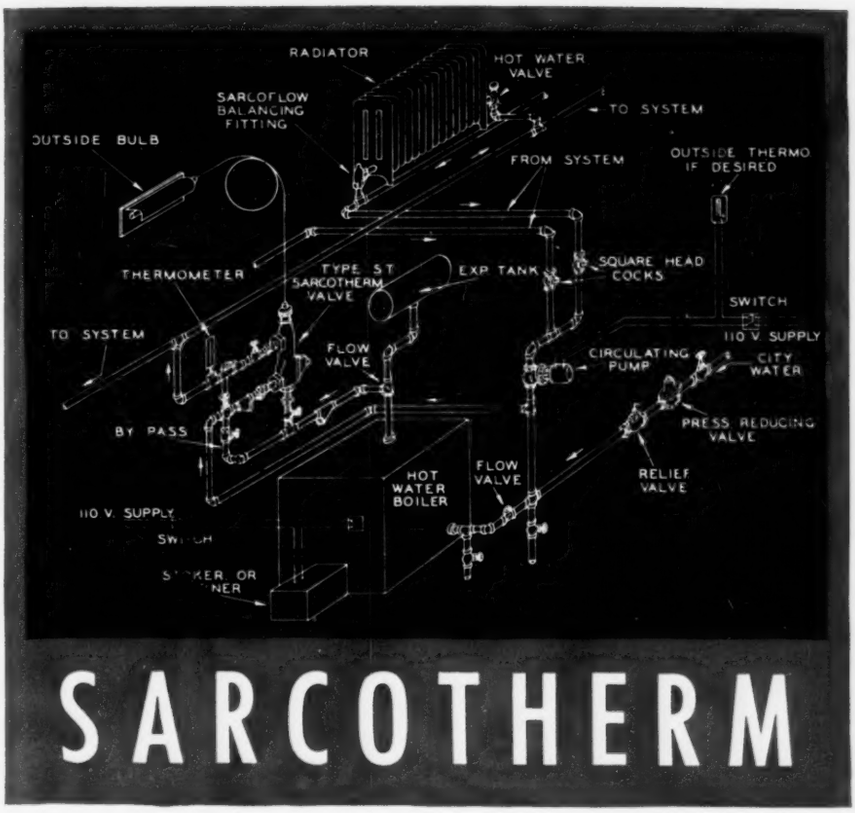
NOTE the "Flame Cut" cross section showing the proportionately high firebox for complete combustion . . . the two-pass travel of gases from the rear to the front, then to the rear again . . . the Spinner Blades which fling the hot gases against the tubes. Note also the large water content and unobstructed waterways which permit steam to rise without unnecessary turbelance. YES . . . the Round "R" is a "Saving" boiler.

For Oil, Gas, Stoker, or Hand Fired
Sizes to Heat 225 to 1737 Sq. Ft. Steam

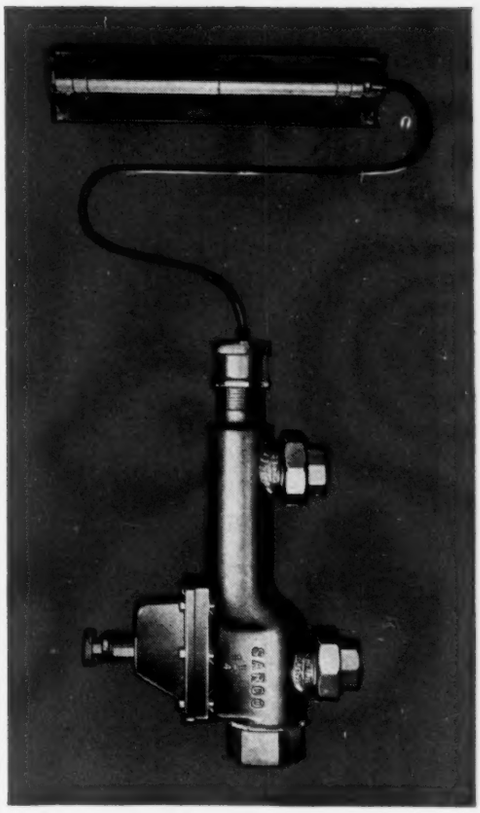
ARMY (E) NAVY

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

75 YEARS BOILERMAKERS



SARCOTHERM



HOT WATER HEATING CONTROL

Provides

CONTINUOUS CIRCULATION CONTROLLED BY OUTSIDE TEMPERATURE

on new or old systems for all types of buildings.

•

Ideal control for Radiant Heating.

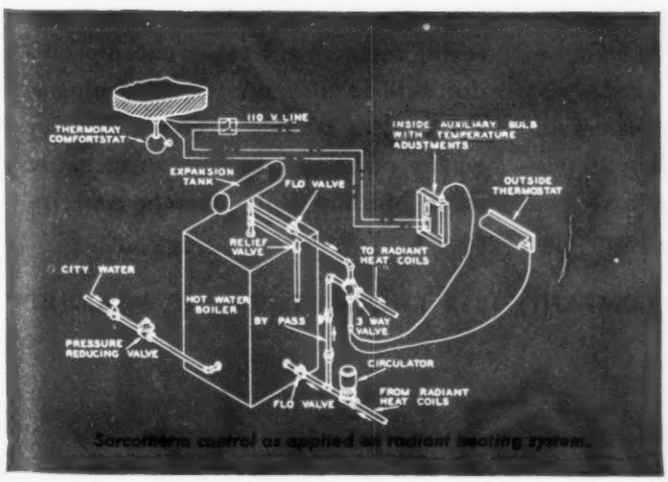
When you can tell the owner that "the best costs less" your advice will be heeded.

Sarcotherm is best because it is a simple, sturdy valve that constantly recirculates unused heat with modulated control and anticipation of room temperature fluctuations. No on and off, no "cold seventies."

It costs less because it is relatively inexpensive to install, permits higher water temperatures, smaller radiators and pipes, with less strain on the boilers. It also assures large fuel savings by preventing overheating in mild weather.

Ask for catalog No. 1.

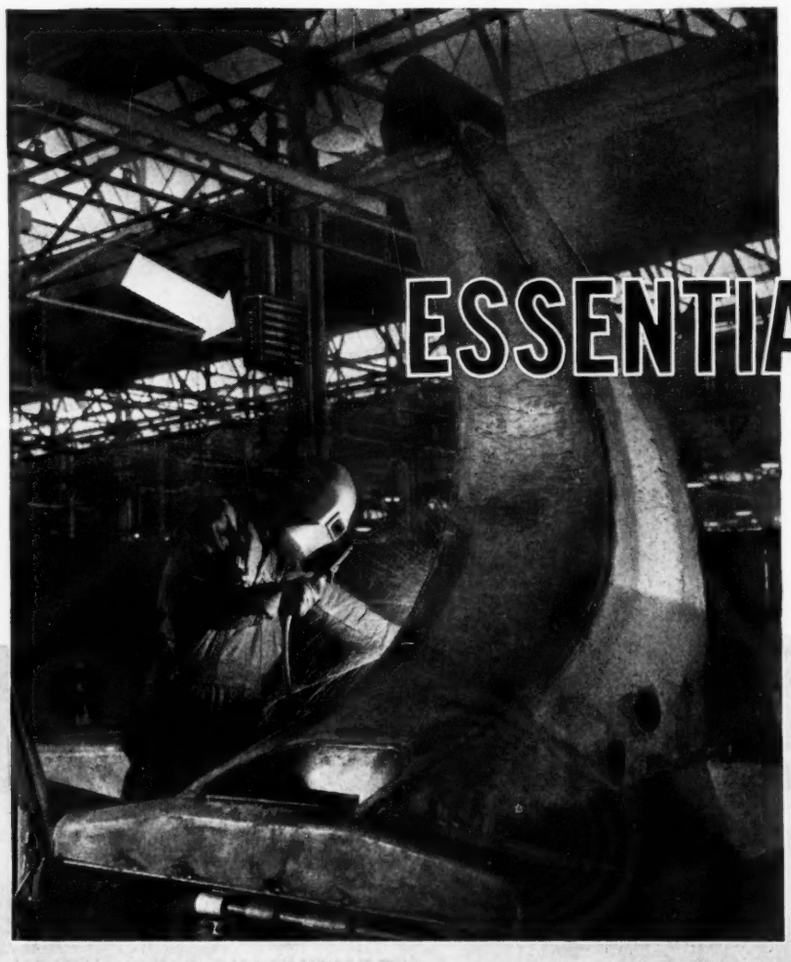
SARCOTHERM CONTROLS, INC., 222 N. Bank Drive, Chicago 54, Ill.



Sarcotherm control as applied to radiant heating system.

When Sarcotherm is used to control a radiant heating system, the thermoray is substituted for the room thermostat.

It is sensitive to both air temperature and radiant rays, and is thus responsive to the heat loss conditions affecting the human body.

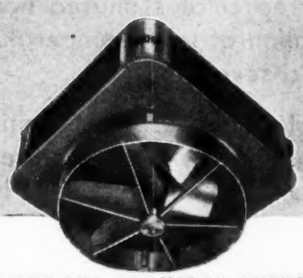


ESSENTIAL HEATING!

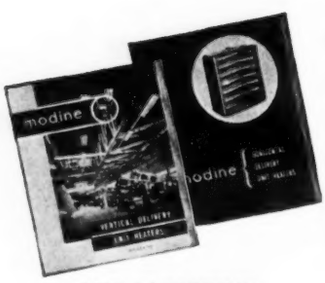
HORIZONTAL DELIVERY MODEL

MAKE urgently needed REPLACEMENTS with

MODINE UNIT HEATERS



VERTICAL DELIVERY MODEL



GET BULLETINS 144 and 144-A

● In war plants producing critical supplies...there are leaky, slow-heating, fuel-wasting pipe coil or cast iron radiators, or old, worn out unit heaters that need to be replaced. Make such urgently needed replacements with Modine Unit Heaters . . .

They will save fuel—as much as 25 per cent over cast iron radiation. Save upkeep and repairs. Today's replacements, properly planned, will fit into tomorrow's reconverted installations.

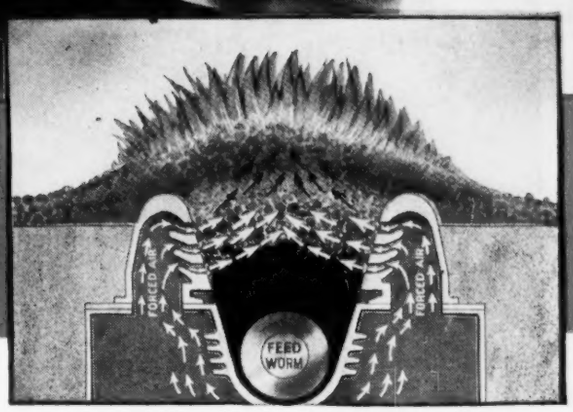
Modine's 29 years of cumulative pioneering research and experienced production skill is concentrated on turning out unit heaters capable of giving that same quality of heating performance that has made Modine Unit Heaters America's *recognized standard!*

MODINE MANUFACTURING COMPANY, 1812 RACINE ST., RACINE, WISCONSIN

Modine Unit Heaters

Only the FIRE TENDER HAS THE Econo-Mixer

..... In all Stoker History No Sales Feature has Equaled THIS



The design of FireTender Retort and Tuyeres (the Econo-Mixer) the greatest advancement yet made in stoker engineering.

Cooling FINS on the retort casting and on the bottom of the indbox keep the coal cool until it gets INTO the retort. This pre-nts the coal from choking and packing in the worm—this saves rrent by reducing friction and keeps the gases in the coal until leased *at the proper time* by the heat in the retort.

In the long, narrow retort and tuyeres where the coal is loosely acked to permit free circulation, the metered, *forced* air is *COR-ECTLY* mixed with the rising gases to give the most perfect com-ustion yet achieved by the stoker industry.

he ECONO-MIXER DEVELOPS THE MOST HEAT FROM HE SMALLEST AMOUNT OF FUEL—More heat for LESS ONEY.

hat's the big selling point FireTender Stokers give dealers for 45. Investigate FIRETENDER NOW!

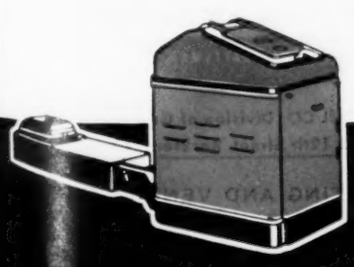
Just like a BLOW TORCH!

Without forced air the blow torch flame is yellow and weak . . . but *add* the *CORRECT AMOUNT OF FORCED AIR* to the *GAS* and you get a *HOT*, blue flame! No more fuel is burned. It's mixing the proper amount of air with the gas that does it.
The Econo-Mixer does exactly that to give the most heat for less fuel and money!

NO OTHER STOKER HAS THE "ECONO-MIXER"!

DEALERS — DISTRIBUTORS

Write or Wire NOW for information on territories still open. Get ready NOW for the huge residential stoker boom when it comes.



HOLCOMB & HOKE MFG. CO.

INDIANAPOLIS 7, INDIANA

HYDRAULIC BENDERS FOR PIPE SIZES 1¼" TO 4½"

EASE—One man pumping handles makes fast, accurate bends.

SPEED—Does perfect bending job in a few minutes. Graduated ram assures exact duplication of any bend on other pipe. Increases productivity of each man on job.

POWER—Maximum piston pressure of 40 tons for precision bends in pipe from 1¼ to 4½ inch.

PORTABILITY—A compact unit in factory-built carrying case . . . easily carried to the job and set up. Complete unit with quick-change attachments included in carrying case.

ECONOMY—Original cost low compared with savings provided. Leading contractors report labor savings of over 50%; minimum material spoilage; practically no maintenance costs.

TWO MODELS—No. 770 bends conduit from 1¼ to 3 inch. No. 775 especially designed to handle larger size pipe from 3 to 4½ inch. Motor drive attachments available for both of these GREENLEE Bender units.

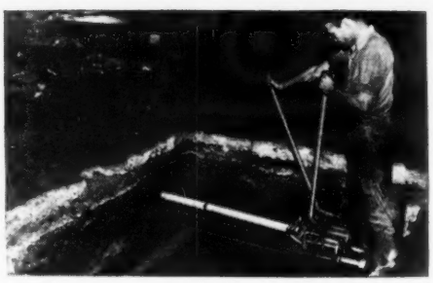
Bend Pipe Cold...With Greenlee Bender

Make "on the job" pipe bends with a GREENLEE Hydraulic Bender. Speed installations this efficient, easy, economical way . . . whether you're working with 1¼" pipe or sizes *up through* 4½".

With a GREENLEE *one man* gets smooth, accurate, uniform bends in just a few minutes. Important savings result through the elimination of manufactured bends, many fittings and the work of threading and installing them. Yet, *in time-savings alone*, the GREENLEE pays for itself the first few times used . . . lets you move on to more new jobs each day.

The GREENLEE Bender, besides being simple to operate, is easy to carry, easy to set up and shift from job to job . . . you bend pipe exactly where and when you want it! *Remember this when planning radiant heating jobs.*

Whatever your requirements, you'll find a GREENLEE Bender for them . . . hydraulic models for pipe from 1¼" to 4½" . . . hand benders for steel, aluminum, brass and copper tubing. Write today for your free copy of Bender Booklet S-116 for complete details on these time and material saving GREENLEE tools for pipe working.



INSTALL PIPE UNDER OBSTACLES WITH

GREENLEE HYDRAULIC PIPE PUSHER

With a GREENLEE *one man* can push pipe under streets, walks, lawns, floors and other obstructions. Eliminates extensive ditching, tunneling, back-filling, re-paving. Two models—for pushing pipe from ¾" size up to concrete sewer type. Write for free GREENLEE booklet S-117.

Get Ready with Greenlee!

REGISTERED TOOLS

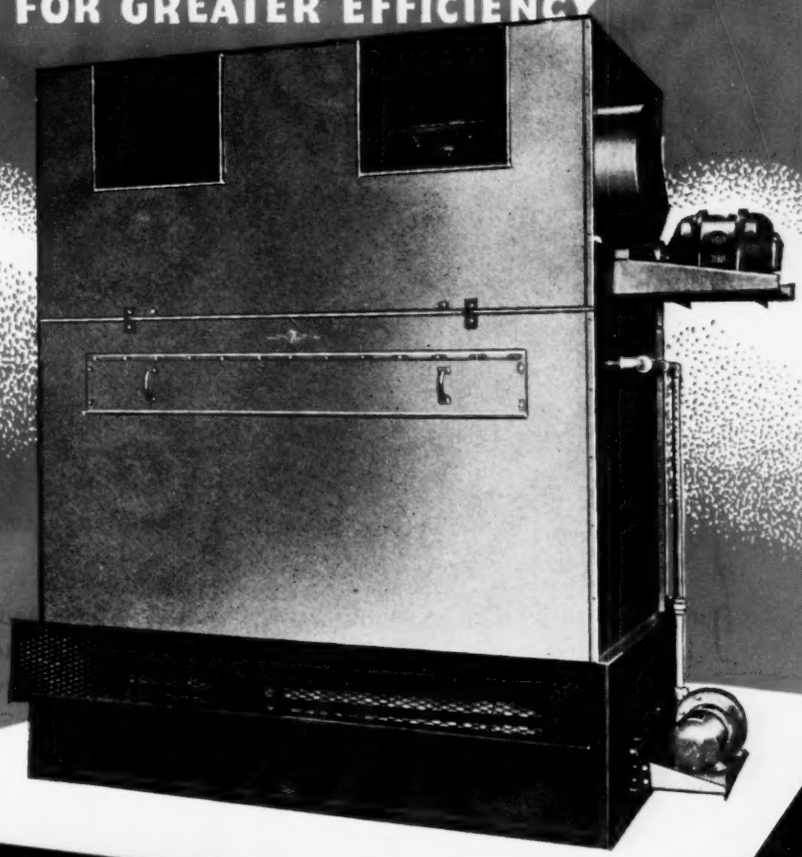
GREENLEE

FOR THE CRAFTSMAN

GREENLEE TOOL CO., Division of Greenlee Bros. & Co., 2325 12th Street, Rockford, Illinois.

Evaporative Condensers

ENGINEERED FOR GREATER EFFICIENCY



Out of more than 25 years experience in manufacturing refrigeration and air conditioning equipment for the industry comes the development of this year's models of Acme Evaporative Condensers.

Wherever water supply presents a problem they furnish the most efficient and economical solution. For Acme has found a way to provide plenty of cooling surface without the use of fins and conserve valuable space.

Cooling coils are all prime surface and especially designed for evaporative condensers. Arrangement of tubes creates greater air turbulence — increased heat transfer — and minimizes refrigerant pressure drop. Tubes so arranged that the coils are easily cleanable.

Definitely they're more efficient. A wide range of capacities. Write for catalog No. 27.

ACME PRODUCTS

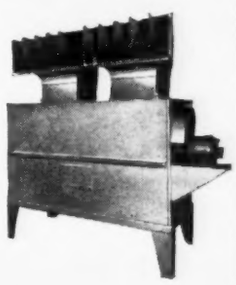
★★★

ACME INDUSTRIES
JACKSON, MICHIGAN

Evaporative Condensers
Ammonia Condensers
Freon Condensers
Dry-Ex Water Coolers
Flooded Water Coolers
Hi-Peak Water Coolers
Pipe Coils
Heat Interchangers
Oil Separators
Liquid Receivers
Forced Convection Units
Heat Exchangers

Write for Catalog on any item.

BLO-COLD
FORCED AIR COOLERS



● Floor type units for high or low temperature requirements wherever forced air cooling is advisable. Dry fin coil type and brine spray models—a unit for any job. Our engineers are at your service if they can be of help to you. For complete recommendations — write for Catalog No. 32.

Your Plans for Postwar Expansion and Modernization Will Include Refrigeration and Air-Conditioning . . . All Requirements Will Be Met by

CURTIS

COMMERCIAL REFRIGERATION AND AIR-CONDITIONING UNITS

Users attest to the dependable, trouble-free, and economical performance of Curtis Equipment.

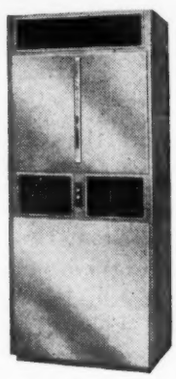
Just as Curtis is today planning ahead to add new units and to improve and refine many features to keep pace with postwar demand, you, too, should be seriously thinking of the postwar market for air conditioning and refrigeration equipment.

All reports definitely prove the fact that of all industries scheduled for postwar expansion, air conditioning and refrigeration are close to the top. You can get your share of this business by laying a solid foundation *now*, and you can count on Curtis to assist you in every way possible.

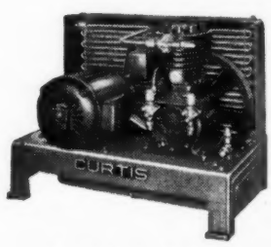
Today, all Curtis Units except packaged air-conditioners are available under proper allocation. When Victory is won, the complete Curtis line, improved, up-to-the-minute, and reflecting the experience gained over 91 years, will be ready for you. But — start planning now!

Write for Complete Information

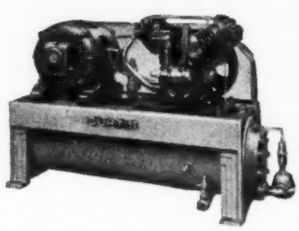
You'll be interested in reading about the possibilities in the field of air conditioning and refrigeration. Write today for Bulletins C-64-E, C-68-C, and C-14-M, covering this interesting and profitable business.



5-hp. Curtis Packaged Air-Conditioner



1½ hp. Curtis Condensing Unit



15-hp. Water-cooled, Shell and Tube Condensing Unit

CURTIS REFRIGERATING MACHINE DIVISION

of Curtis Manufacturing Company

1999 Kienlen Avenue, St. Louis 20, Missouri

CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

R-446

FOR VICTORY BUY MORE U. S. WAR BONDS AND STAMPS

SAVES A *CARLOAD A YEAR

. . . BESIDES RELEASING CARETAKER FOR OTHER DUTIES

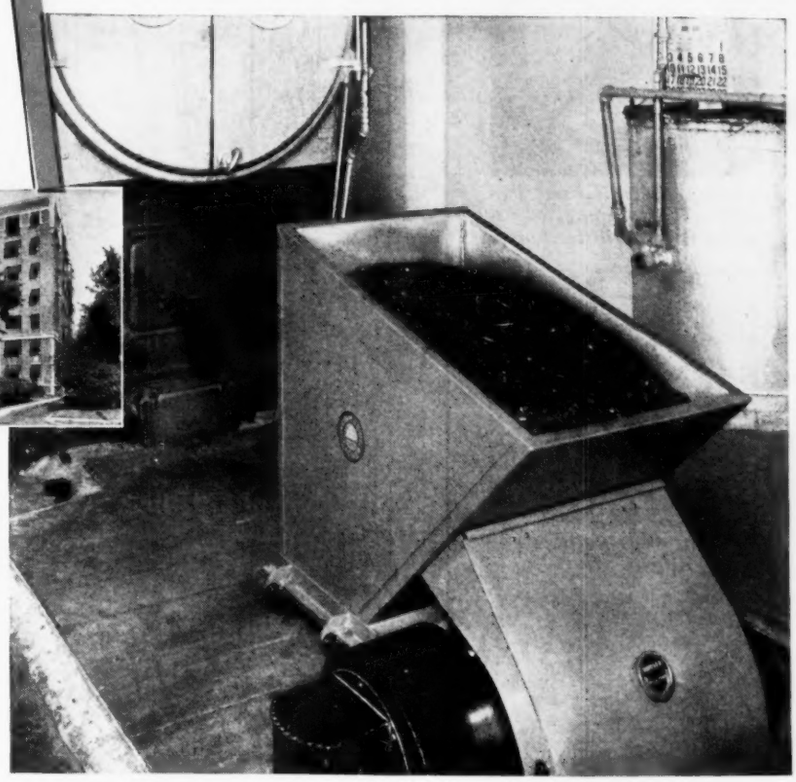
Gentlemen:

In response to your inquiry relative to what kind of service we have been getting from the 300 lb. Winkler Stoker installed three years ago in our forty-three unit apartment building located at 3777 N. Meridian Street, we are pleased to advise that in checking over the expenses, we found that we have made an attractive saving in coal, labor, and depreciation of boiler since it was installed in our Pacific Steam boiler.

* The first year we saved over one carload of coal, besides labor which permitted our caretaker to be available for other duties. Our caretaker informed us this week that he has been using only six wheelbarrow loads of coal a day (24 hour period) whereas we had used more than twelve wheelbarrow loads for a 24 hour day before installation of the Winkler Stoker.

We are pleased to give you this information and if you ever need a recommendation you may refer to us.

Yours very truly,
(NAME ON REQUEST)

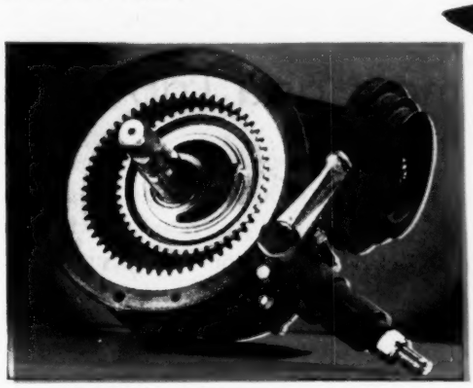


Everybody, these days, knows that stoker-firing reduces heating costs. *How much,* however, depends upon the efficiency of the stoker itself.

In a Winkler Stoker, the inherent economies of stoker-firing are developed to the utmost by sound engineering and failure-proof construction. From the moment coal leaves the hopper or bin it is handled in a manner which permits full utilization of its heat content. With minimum segregation of sizes, the coal is smoothly conveyed to the retort, where it is burned in an accurately metered air flow which assures complete, smokeless combustion at the proper rate.

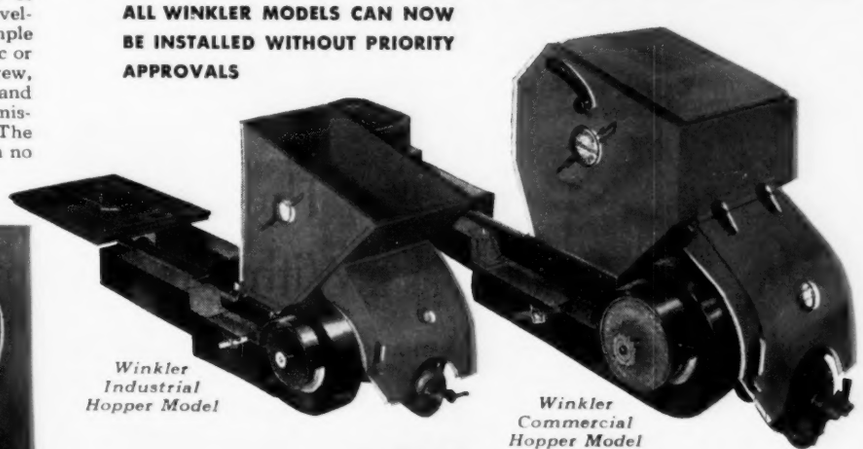
NO SHEAR PIN!

The Winkler further saves money because of service-free operation. The *extra power* developed by its *internal planetary gearing* is ample to crush all ordinary obstructions. If a metallic or uncrushable object should block the feed screw, the Winkler Safety Release automatically and continuously disengages and resets the transmission until the blocking object is removed. The Winkler then resumes normal operation—with no shear pin to replace.



The Winkler "Inter-plan" Drive, with Automatic Safety Release

ALL WINKLER MODELS CAN NOW BE INSTALLED WITHOUT PRIORITY APPROVALS



Winkler Industrial Hopper Model

Winkler Commercial Hopper Model

Winkler Commercial Self-feed Model

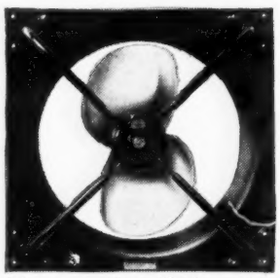
WINKLER

fully automatic STOKERS

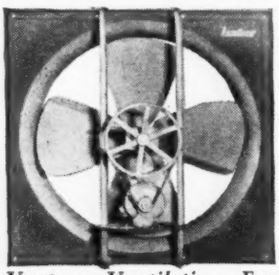
U. S. MACHINE CORPORATION • LEBANON, INDIANA

AMERICAN BLOWER

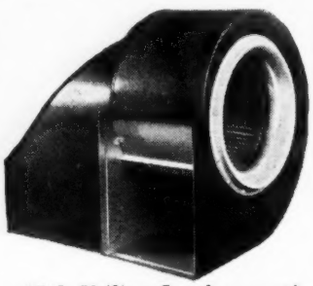
MECH'CRAFT · AIR-CONDITIONING · FLUID DRIVES · DUST COLLECTORS



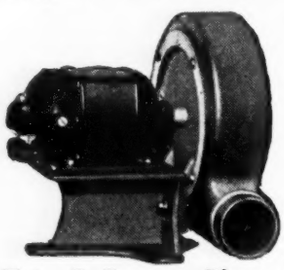
Ventura Ventilating Fan with direct connected 2-speed fully enclosed motor.



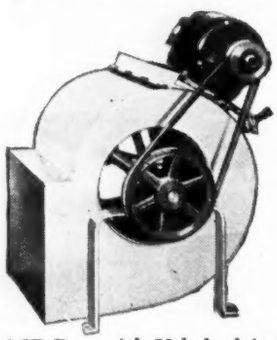
Ventura Ventilating Fan with V-belt drive.



ABC Utility Set for ventilating with a duct system.



Type P Pressure Blowers.



ACF Fan with V-belt drive.

Other fans to meet every air handling need.

The Man Who Won Favor With Management and Labor

THAT MAN is a Ventilating Contractor. He has just proved good ventilation is good business.

AND HE has won favor with management and labor by removing bad air, dangerous gases, dust and odors from the plant. No wonder the plant manager wants to place a picture of this popular Ventilating Contractor in the directors' room.

YES, you've guessed it! He and thousands of other top Ventilating Contractors use American Blower Air Handling Equipment. Regardless of what industry you are in, Bad Air is Bad Business.

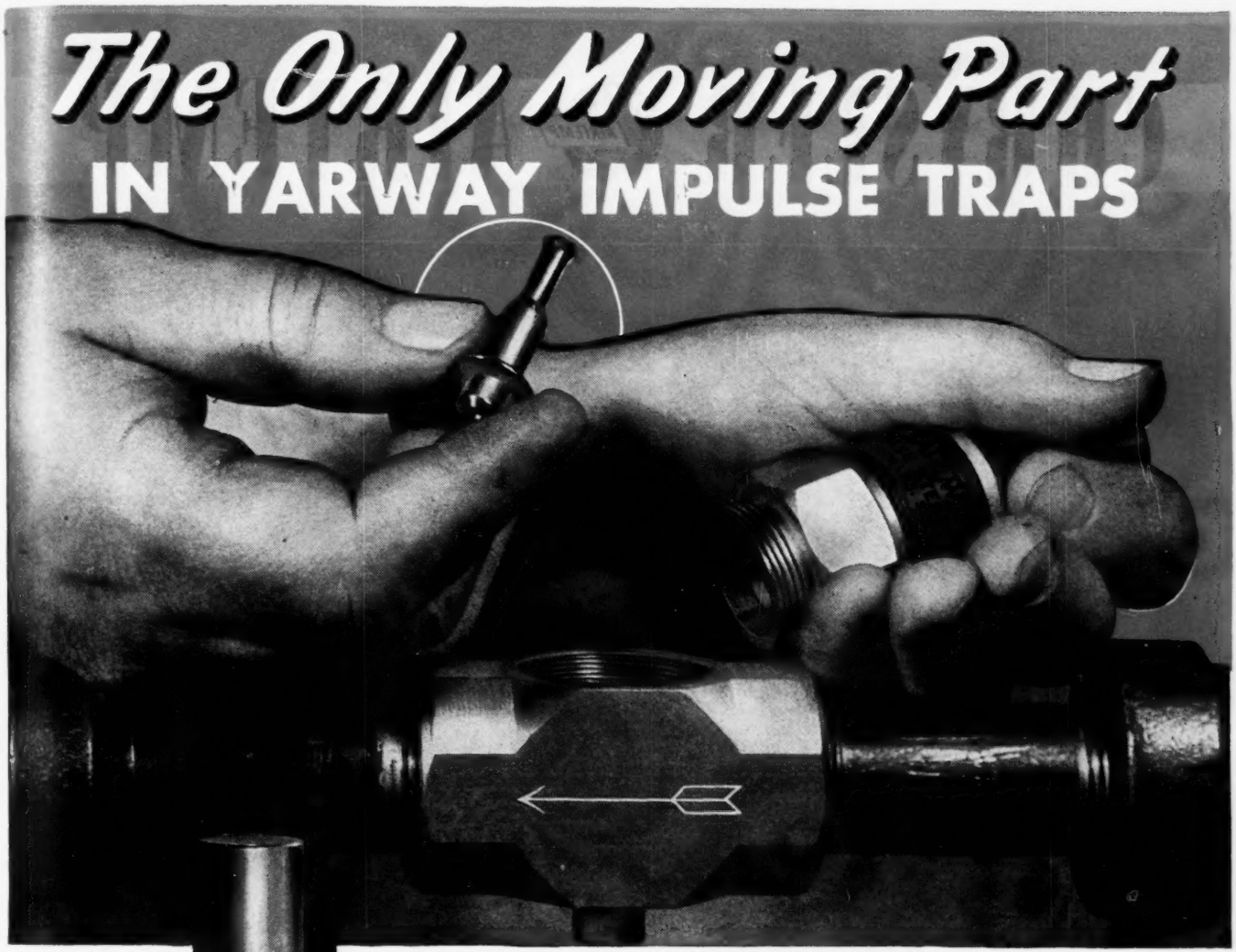
CALL IN a local Ventilating Contractor today—he'll do your job better and more economically.

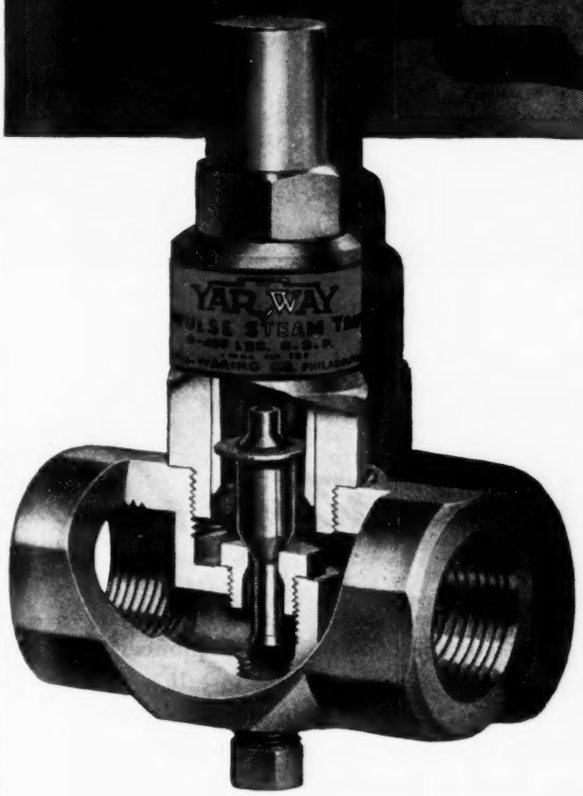
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

The Only Moving Part
IN YARWAY IMPULSE TRAPS





Long life, freedom from repairs and ease of maintenance are three good reasons why more than 400,000 Yarway Impulse Traps have been purchased in the few years since their introduction.

This simple valve—the only moving part—and its replaceable seat—are stainless steel, heat treated. They are good for all pressures.

After years of service, they may be replaced simply by removing the trap bonnet. No need to disconnect the trap from the line. And engineers tell us a handful of these parts will keep a plant full of Yarways in tip-top shape over the years. Far cry from the large inventory of repair parts needed to service other traps.

Maintenance is a major consideration in steam trap selection, of course, but *performance is paramount.* And that is where Yarways really shine. Their continuous discharge on heavy condensate loads gets equipment hotter, sooner, and their intermittent discharge on light loads keeps it hot for maximum operating efficiency, day in and day out.

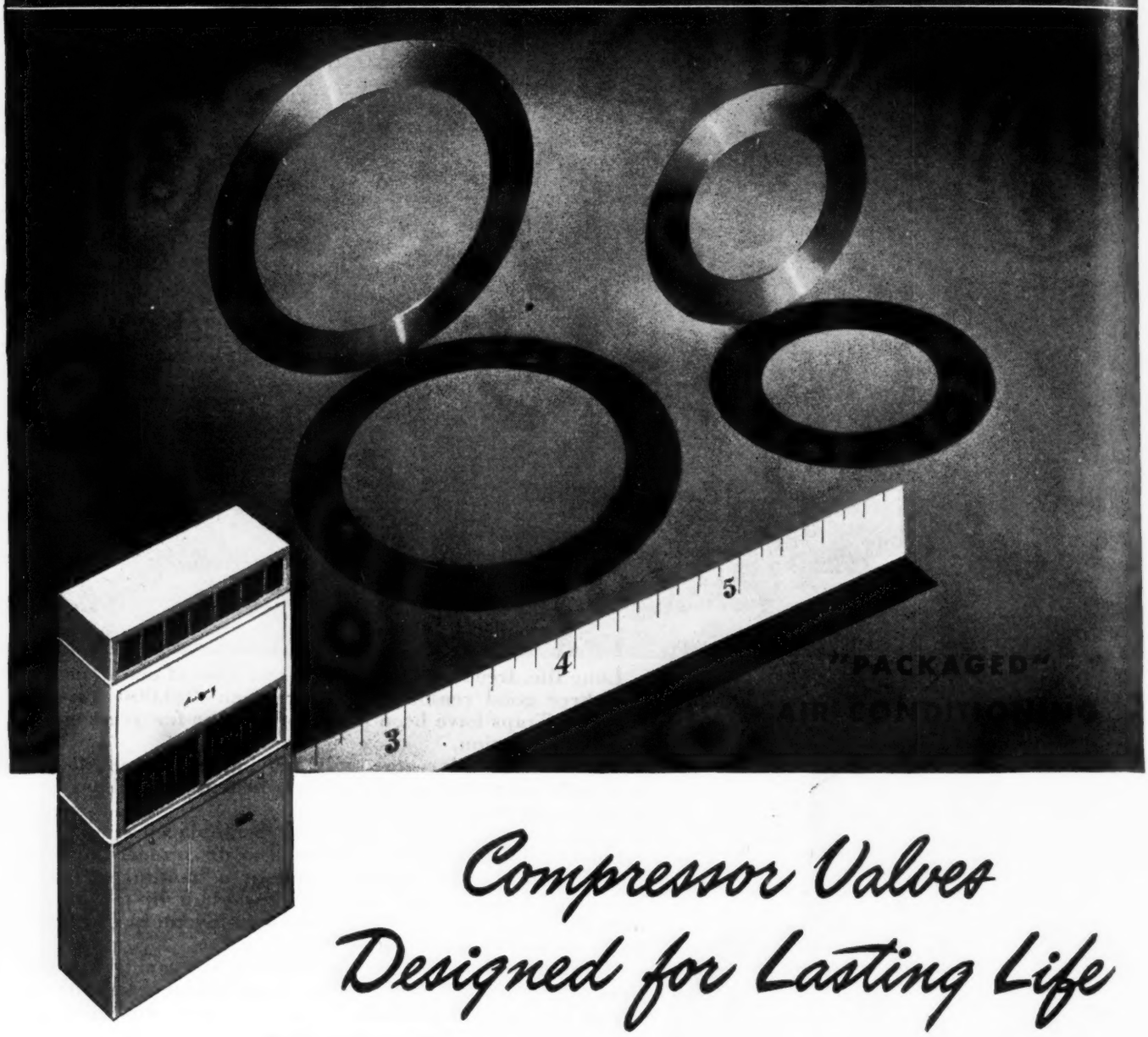
And when you consider, too, it usually costs no more to install Yarway Impulse Traps than to repair other type traps, why not solve your steam trap problem with Yarways? Write for Bulletin T-1739 or see your mill supply distributor. (More than 100 leading dealers feature Yarways.)

YARNALL-WARING CO. 104 Mermaid Ave., Phila. 18, Pa.

Ask about the new Yarway color and sound motion picture, available for group showings

YARWAY IMPULSE STEAM TRAP

CHRYSLER AIRTEMP



Compressor Valves Designed for Lasting Life

Special ring-plate, non-flexing valves are an important feature of Chrysler Airtemp hermetically sealed compressors. Made of finest saw steel, these sturdy valves are pressure lubricated and operate on a "superfinished" seat. Valves that "STAND UP" are another reason why Chrysler Airtemp radial design compressors—with air, dirt, and moisture sealed out—give long, quiet, trouble-free service.

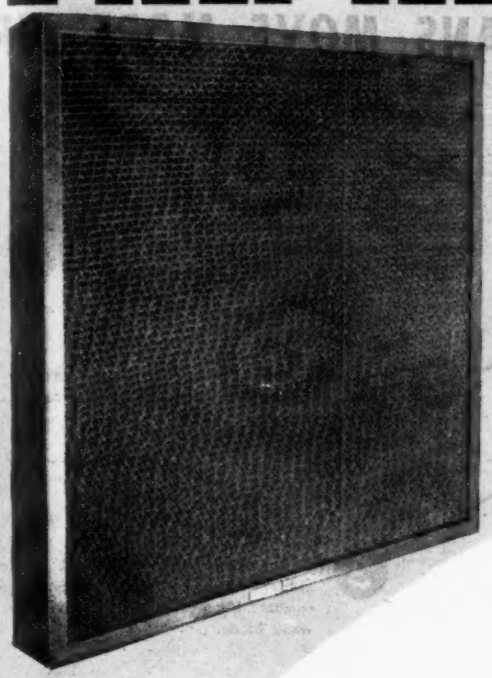
"Packaged" air conditioning units, pioneered by Chrysler Airtemp, are easy to install and economical to operate. When you have temperature-humidity control problems, turn to Chrysler Airtemp. There is a unit and capacity range ideal for practically every air conditioning, commercial or industrial refrigeration requirement. • Airtemp Division of Chrysler Corporation, Dayton 1, Ohio.

Buy More War Bonds! Tune in Major Bowes every Thursday, CBS., 9 p. m. E. W. T.

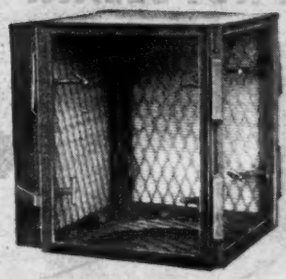
HEATING • COOLING • REFRIGERATION

Prompt Shipment

FAR-AIR FILTERS



Standard Panel and Grease Filters SIZES
16" x 20" x 2"
16" x 25" x 2"
20" x 20" x 2"
20" x 25" x 2"



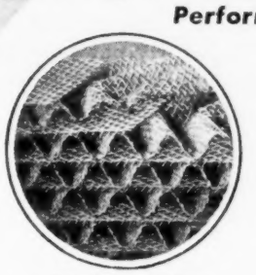
Diesel Engine Assembly

Railroad

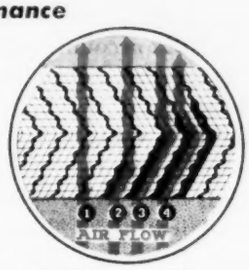
Round

New IN PRINCIPLE

Engineered for Exceptional Performance



Here's how it looks —front view



Here's how it works —cross-sectional diagram

Wire screen crimped in herringbone pattern and flat wire screen, in alternate layers, form the filter, as illustrated above (left). Air enters the channelled openings and process of filtration is indicated by the progressive diagram (right). Here are some of the advantages of Far-Air Filters—

30% more air capacity
Longer life
Washable in place
Lower pressure drop
Larger dust holding capacity

Revolutionary Herringbone Construction Gives 50% Greater Efficiency

Now you can get the filters you want for better air cleaning. Supplied in great quantities for war needs, these new type filters can now be delivered in limited numbers for less critical uses.

As compared to ordinary types, they're better, more efficient and longer lasting. They'll do the same job in two-thirds the space. You can clean them easily and quickly—use them over and over indefinitely.

Originally developed and proven in principle before the war, and now refined and improved for fighting needs, Far-Air Filters are ready to give you greatly superior performance at much lower operating cost. Write today for full details. Address—Dept. H, Farr Company, 2615 Southwest Drive, Los Angeles 43, California.

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FARR COMPANY

MANUFACTURING ENGINEERS

LOS ANGELES CALIFORNIA

"Better by Farr"

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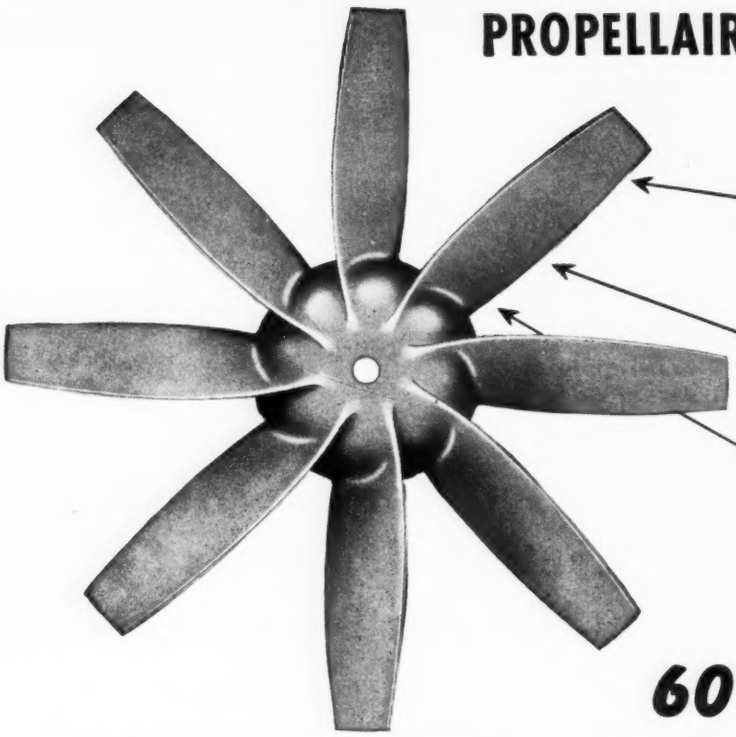
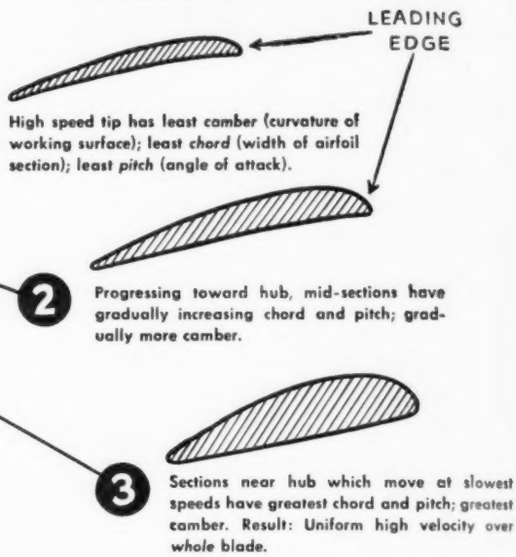
BOTH Sides of these Blades WORK . . . and over the full length.

That's why PROPELLAIR FANS MOVE MORE AIR!




LEADING EDGE
1
High speed tip has least camber (curvature of working surface); least *chord* (width of airfoil section); least *pitch* (angle of attack).
2
Progressing toward hub, mid-sections have gradually increasing chord and pitch; gradually more camber.
3
Sections near hub which move at slowest speeds have greatest chord and pitch; greatest camber. Result: Uniform high velocity over *whole* blade.

60% of Air Movement is produced by back of blade

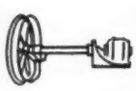
Like modern aircraft wings, *both* surfaces of Propellair airfoil-section fan blades produce air movement. Suction created at the back of the blade accounts for about *sixty* per cent, while thrust from the front accounts for about forty per cent. Only blades of *airfoil-section design* combine these *two* forces to maximum advantage.

All points on a fan blade, however, do not travel at the same speed. The greater the radius, the higher the linear speed—and in many fans this means the *tips* do practically *all* of the work. *Not so* in Propellair design. By scientific variation of camber, chord, and pitch, Propellair engineers have perfected a blade which develops *high, uniform velocity* over the *whole* fan area.

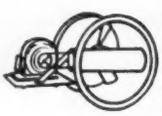
Propellair fans deliver *maximum* volume, require *minimum* torque, are non-overloading, take little space for installation . . . save money at *every* turn.

For Every Ventilating Need

CD—Direct connected to electric motor. For ducts, hoods, roof ventilators, and for mounting in walls, windows.



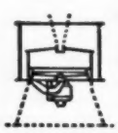
CE—Extended-shaft fans for ducts, dryers, etc., where motor must be outside of air stream. Takes little space.



CS—A heavy-duty belt-driven design for ducts or stacks to handle explosive vapors, dust, or high temperatures.

CU—Low-stand, tiltable, portable cradle fan for product drying or cooling, and similar services. Made in all sizes and capacities.

CM—Sturdy, heavy-duty portable pedestal fan for cooling men or products wherever needed.



VERTI-STACK—for roof ventilation. Horizontal fan forces heat, dust, fumes high into air. Butterfly dampers open wide, close automatically.

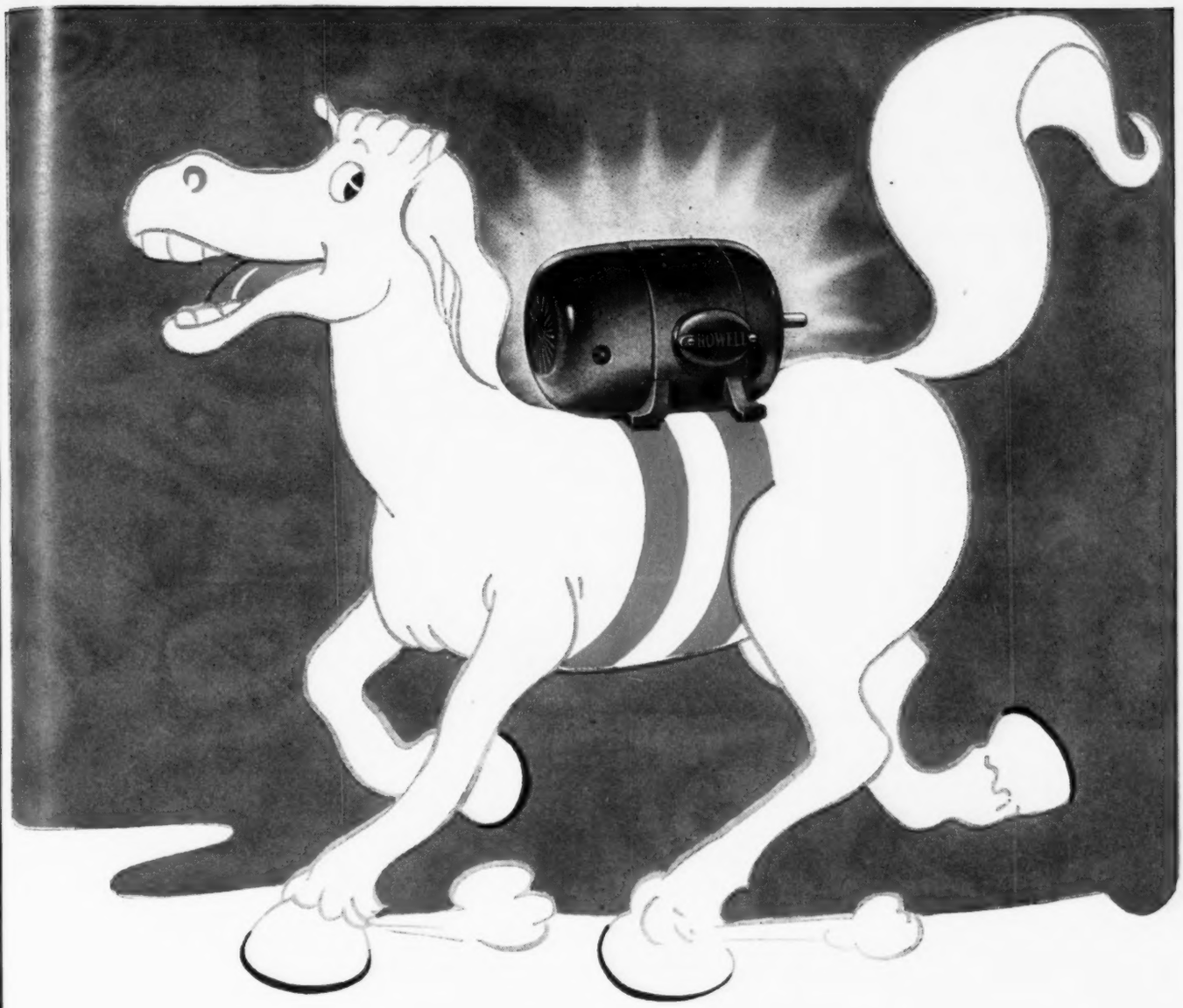
CURVED ENTRANCE RING FOR GREATER VOLUME

This airfoil-principle curved entrance ring, another Propellair development, virtually eliminates eddy currents; reduces flow restrictions; serves as sturdy support for fan and enclosed motor.

Yours Free

Send for 72-page book. It represents 15 years of exclusive specialization in propeller fans. Ask us for Catalog 10-HV.

PROPELLAIR, Inc. "Moving Air is our Business" SPRINGFIELD · OHIO



It may come to this—

but we won't cut Howell Quality

The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.

Yes, it may even come to the point where we have to press the good old Howell Horse into service to make deliveries on our famous motors. That's how serious the delivery situation is in the entire electric motor industry today.

But there's one thing you can count on now, as always—*we'll never, never cut Howell quality.* Every Howell Motor is built of the finest material, statically and dynamically balanced, and thoroughly insulated throughout.

So, until the delivery situation clears up, please bear with us. We recognize our obligations fully. We are putting forth our maximum efforts to build more and more Howell Motors, and to see that they are distributed among users whose needs are most vital to the war effort. This, we know, is as you would have it.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

HONEYWELL

Announces!!

SERVICE SCHOOLS

IN PRINCIPAL LOCALITIES

for

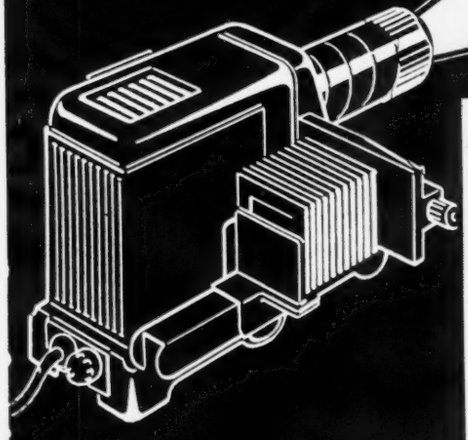
INSTALLATION MEN

SERVICE MEN

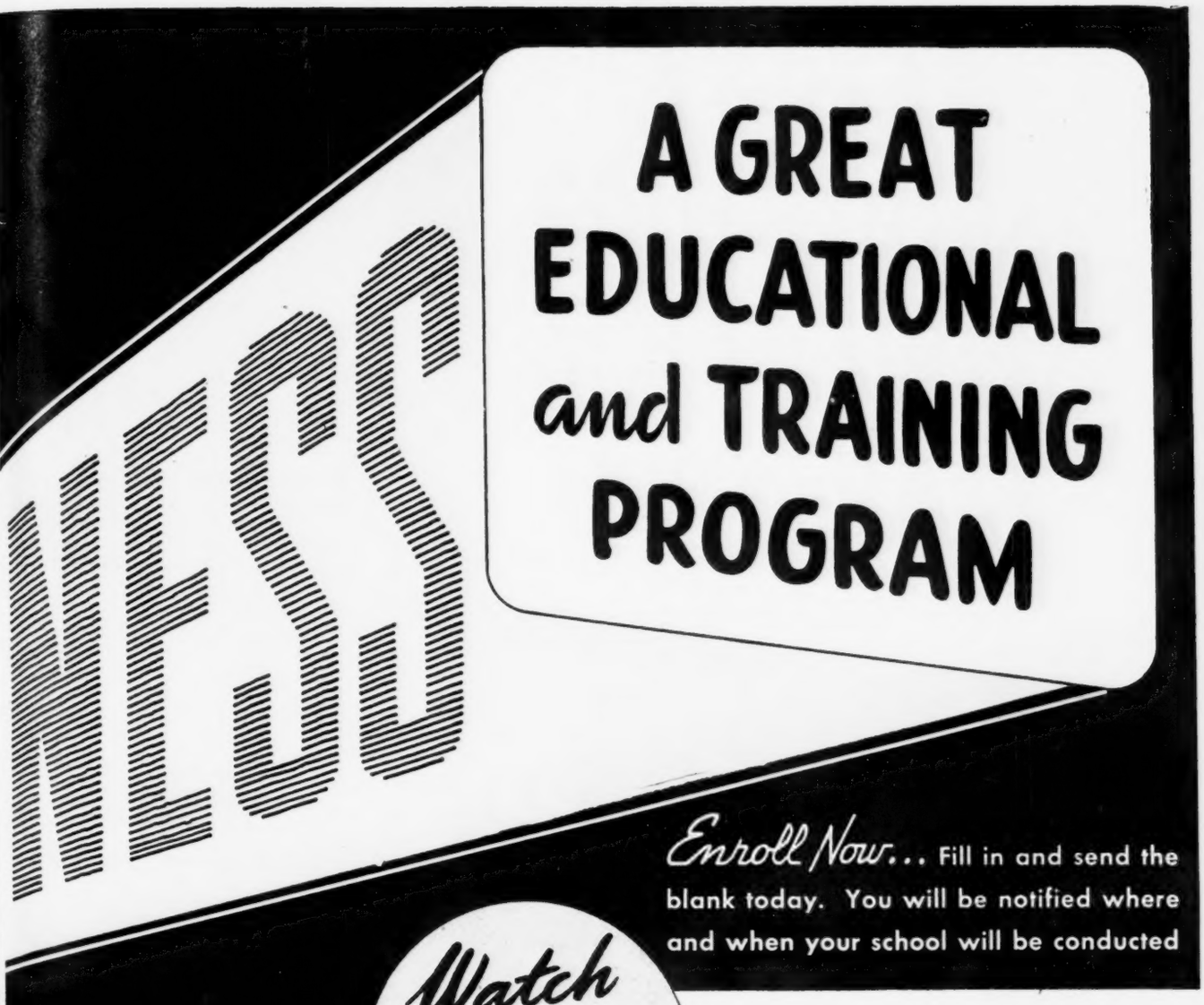
SALESMEN

STUDENTS

HEAT IN HAR



VIRTUALLY everyone in the automatic heating industry has recognized the need for a training course for installation and service men. Minneapolis-Honeywell, however, is the first actually to make such a course available on a national basis. This course has been prepared by Honeywell engineers with the help of America's most outstanding organization in the field of visual education. It has been in preparation for more than a year and covers every phase of automatic heating control and its application. Schools will be conducted in principal cities throughout the country and will be available, without cost or obligation, to all interested. Fill in and send the registration form at the right. You will be advised when schools will be opened in your locality.


A GREAT
EDUCATIONAL
and TRAINING
PROGRAM
Enroll Now... Fill in and send the blank today. You will be notified where and when your school will be conducted
Watch for Details

MINNEAPOLIS-HONEYWELL
offers a complete course in automatic controls and their applications ...including **MODUFLOW**

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DATE _____

☐ **Please enroll me in the Honeywell Control Course "HEAT IN HARNESS"**

☐ **Please give me additional information.**

NAME _____

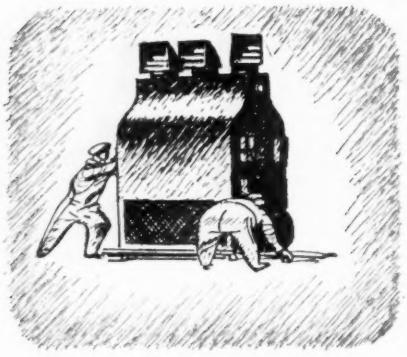
ADDRESS _____

CITY _____ (ZONE) STATE _____

COMPANY _____

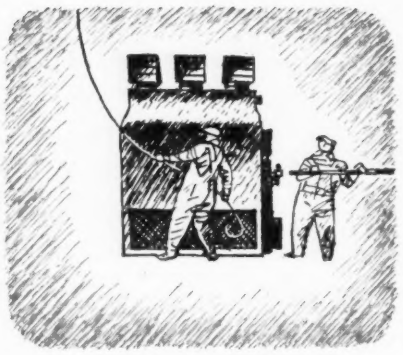
POSITION _____ PHONE _____

a heating system should:



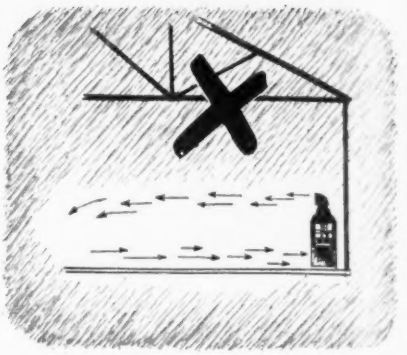
be easy to install

Dravo direct fired warm air heaters are shipped from the factory with the refractory lining in place, the unit complete—ready to produce heat. Installation is a clean job, quickly accomplished.



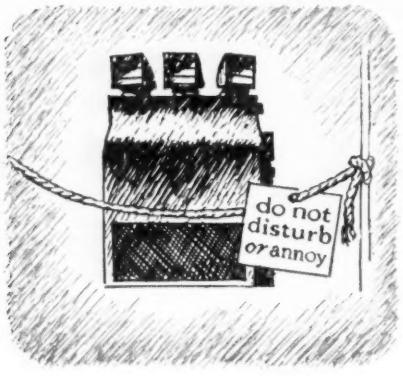
easy to connect

Where either gas or oil is the fuel to be used the heaters require only to be connected with the fuel pipe and to the power line. Heat can be on tap just a few hours after the heater is moved in.



heat directionally

Top discharge—bottom intake tends to arrest the normal upward flow of warm air, keep the heat in the working area, where it belongs, and not in the roof trusses.

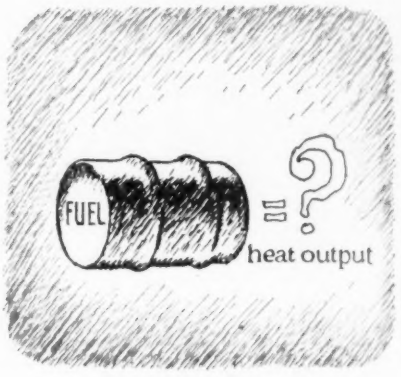


be self sufficient

Gas or oil fired models are practically automatic, require no regular maintenance. Once the ignition button is pressed thermostatic controls do the rest. Any employee can regulate.

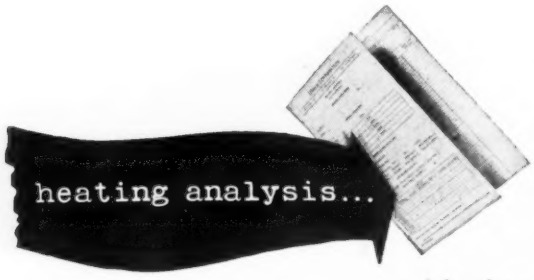
give pleasant heat

Dravo direct fired warm air heaters are easy to regulate for volume and direction so that workmen can enjoy clean, comfortable heat and even temperature throughout the season.



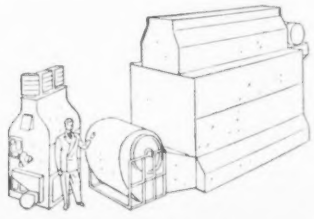
be +80% efficient

Conditions vary with each building but Dravo direct fired heaters for gas or oil have constantly shown between 80-85% efficiency in test results—more BTUs from the same amount of fuel.

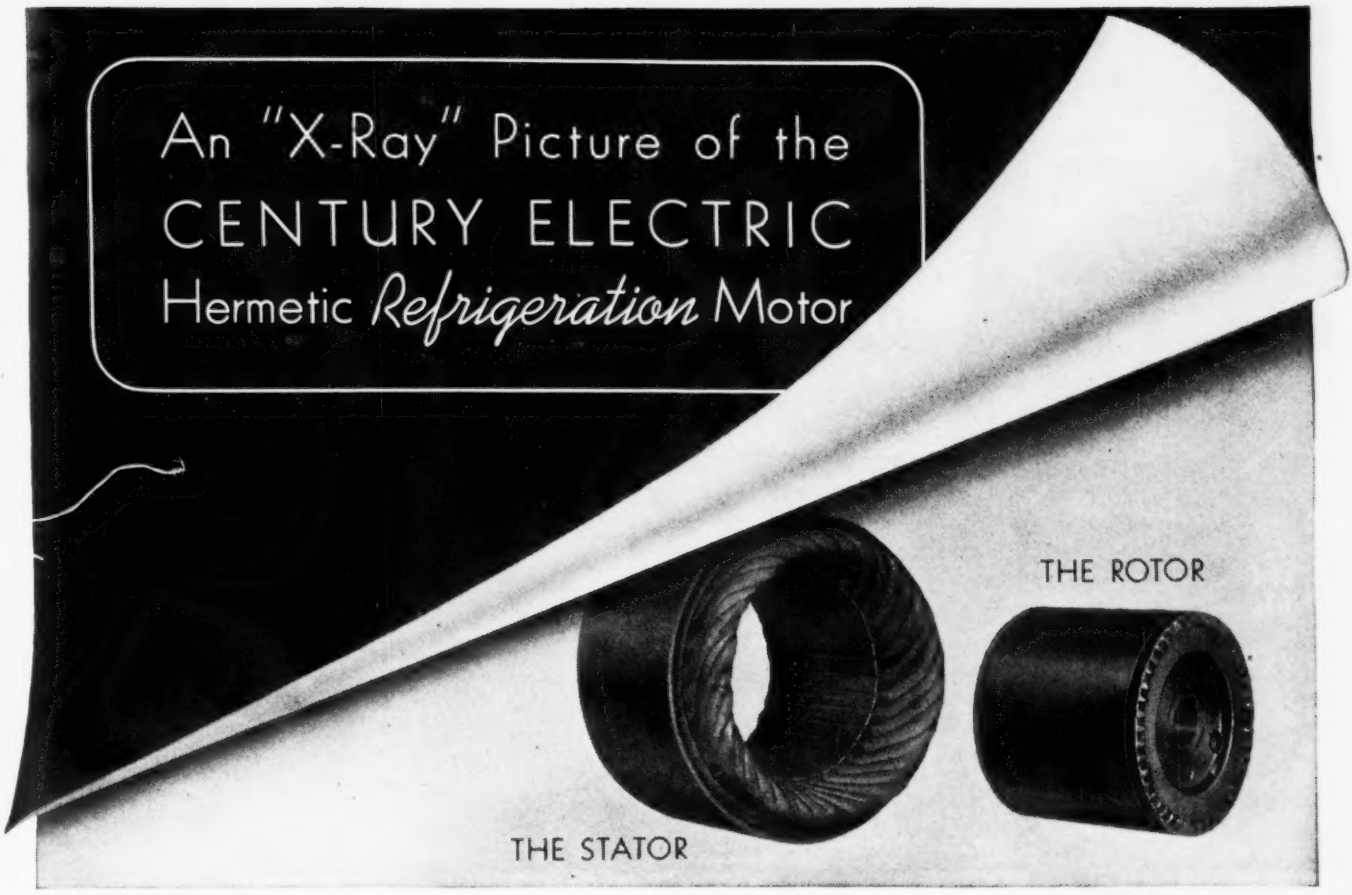


The advantages pictured above are inherent to direct fired warm air heating and are available for any building where this type of heat is applicable. They can function as independent portable units; they can be installed in out-of-the way plant areas to provide supplementary heat; they can be hung from the walls when floor space is not available; they can be moved from place to place during building construction and be retained as permanent heating systems afterward. Air cooling and cleaning can be arranged in conjunction with them. Will this method fit any building you have to heat? Our Building Survey Report will help organize the data we need to suggest a layout and quote a price. Write for a copy—address Dravo Corporation, Heater Department, 300 Penn Avenue, Pittsburgh 22, Pa.

DRAVO
HEATING



300,000 TO 4,000,000 B.T.U. CAPACITY PLUS UNITS COMBINE FOR ANY DESIRED OUTPUT



Quiet and Unseen, It Will Be Extremely Popular On Many Leading Post-War Air-Conditioning and Refrigeration Units

Quietly and unseen, the Hermetic Motor will furnish the dependable power so necessary for air conditioning comfort or effective food preservation.

Above we show a view of the motor's working parts. The Hermetic Refrigeration Motor has been reduced to just two simple, sealed-in parts — a stator and rotor — which you will hardly recognize as an electric motor.

Sealed-in motors are not new. They have been used on small refrigerators quite successfully. But on larger units for air conditioning and frozen foods, Century engineers had to overcome many obstacles. For example, ordinary insulation on the motor windings of smaller units was not satisfactory for the larger motor windings.

Century Engineers were the first to recognize the need for and to develop a combination of magnet wire with a basic new electrical insulation, which made possible, several years ago, the first successful integral horsepower motor for hermetically sealed refrigeration compressors.

Many leading manufacturers of air-conditioning and frozen-food units — whose names are familiar to the American public — will use Century Hermetic Refrigeration Motors for their post-war products.

For top performance and dependability, you can always rely on any of the many types of Century Electric Motors, built in sizes 1/20 to 600 horsepower.

422R

Century C MOTORS

CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

CASH-ACME

THE ONLY

Revolving Head Relief Valves

WITH ALL THESE FEATURES

Write Today . . . FOR THE NEW CASH-ACME CATALOG

28 Fully illustrated pages of detailed information and specifications on the complete line of CASH-ACME Pressure Controls.

- ★ PRESSURE REDUCING & REGULATING VALVES for Water, Air, Steam, Oil, Etc.
- ★ DIAPHRAGM TYPE PRESSURE & TEMPERATURE RELIEF VALVES
- ★ POP TYPE RELIEF VALVES
- ★ AUTOMATIC PRESSURE CONTROLS for Hot Water Heating Systems
- ★ STRAINERS ★ VACUUM VALVES

A *Cash-Acme* FIRST...

The CASH-ACME Type RH (Revolving Head) Pop Type Relief Valve . . . produced after months of experiment and test, was first introduced in 1938 and has since that time proven its worth in thousands of installations.

TWO exceptional design features are responsible for the widely acclaimed popularity of the CASH-ACME RH ....

1st. The REVOLVING HEAD makes it possible to Always have the pressure setting in the most visible position.

2nd. The calibrated spring permits vernier type adjustment of the relief pressure thus eliminating the necessity of an auxiliary pressure gauge.

The RH is made of CAST BRONZE with a NICKEL-CHROME-BRONZE Stick Resisting Seat, stainless steel spring and renewable composition seat discs. Their pressure range is from 30 to 150 pounds inclusive, ample for practically all domestic installations.

Additional features that are available, if desired, include a test lever on the valve which allows the system to be flushed and also allows for an occasional testing of the valve. A temperature protection feature in the form of a simple, fool-proof, fusible plug, when properly installed, protects a hot-water heating tank from becoming dangerously overheated.

JOBBERS ATTENTION

CASH-ACME design features coupled with high quality materials and workmanship have been responsible for the wide popularity of the TYPE RH. Stock regularly, fast moving CASH-ACME products. Order your supply Now. Address Dept. E-2.

Represented in Principle Cities

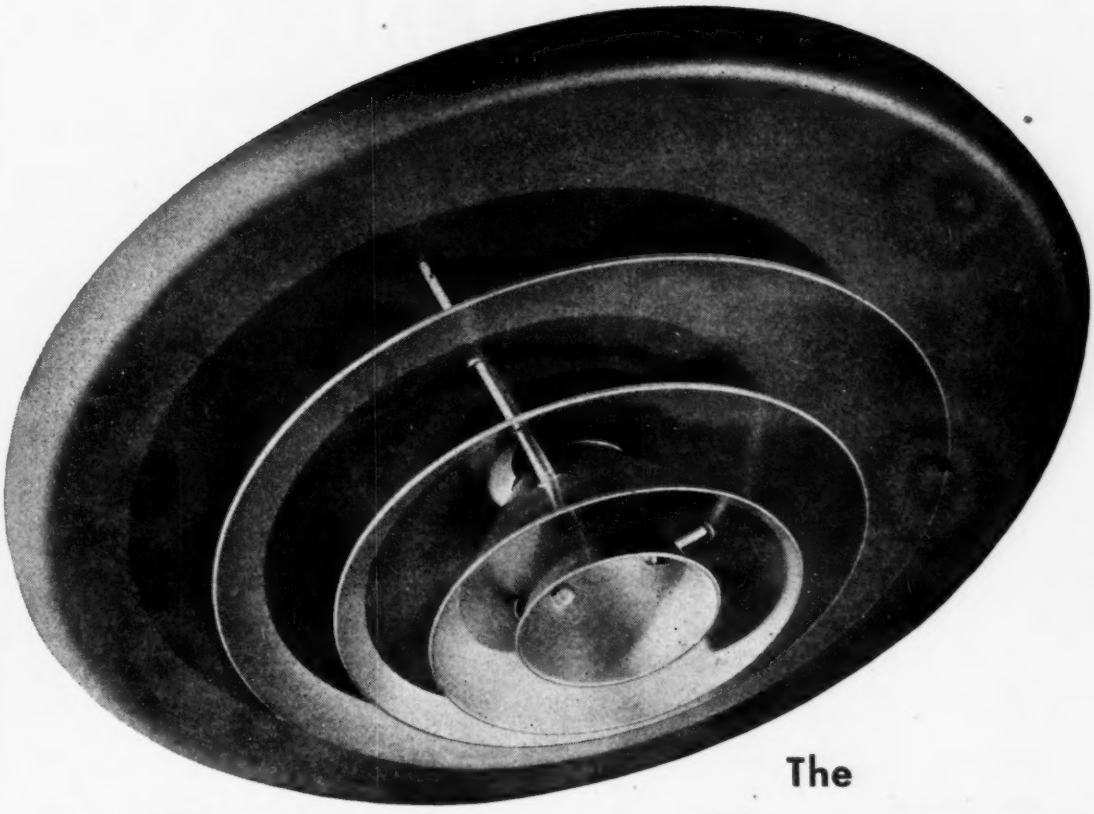
In Automatic Valves...
IT'S *THIS* NAME THAT COUNTS!
CASH-ACME
VALVE DESIGNERS & BUILDERS FOR *Over Twenty Years!*

A. W. CASH VALVE MFG. CORP.

WABASH & MORGAN — P. O. BOX 247

DECATUR (ZONE A) ILLINOIS

No Air Conditioning System is Better than its Air Distribution



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ANEMOSTAT

Draftless *Aspirating* Air Diffusers

are scientifically correct and possess exclusive important features.

A type and size for every condition.

Send for latest Bulletin.

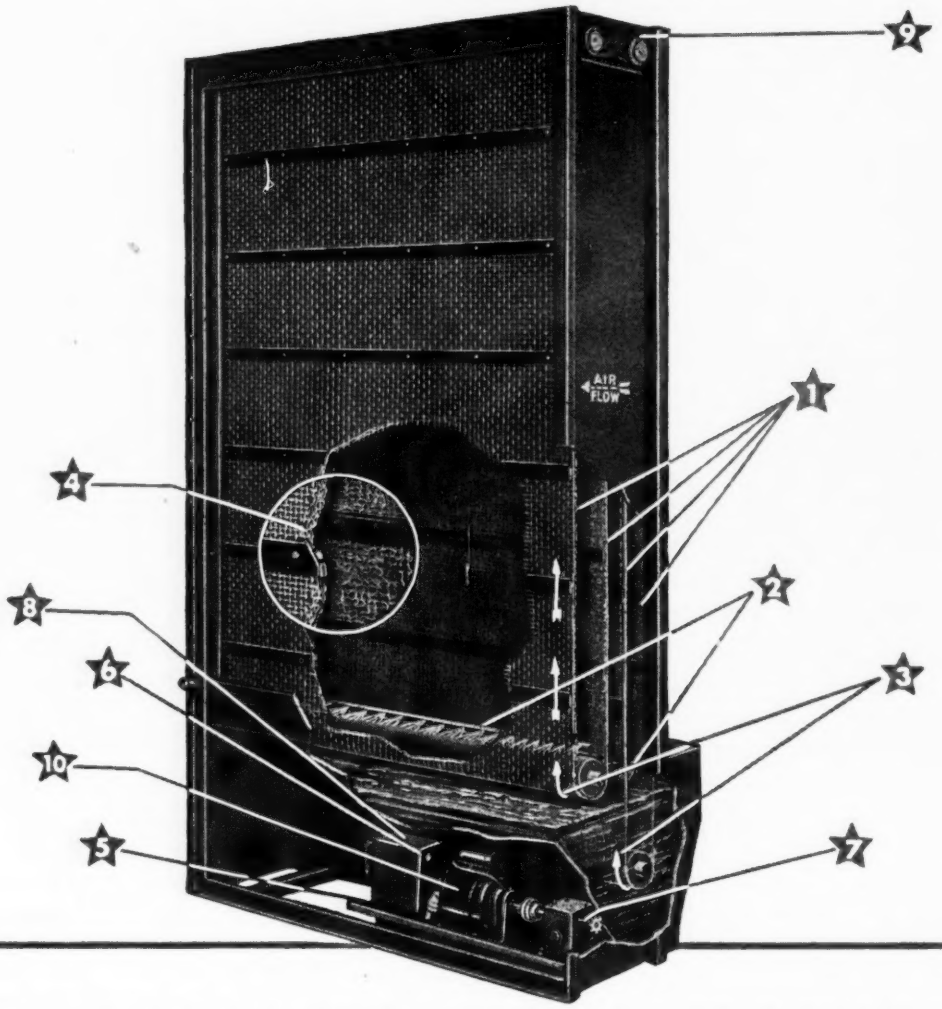
ANEMOSTAT

CORPORATION OF AMERICA

10 East 39th Street • New York 16, N. Y.

STAYNEW AUTOMATIC

No other Air Filter can give you these
10 IMPORTANT FEATURES



1. *Four* Stages of Filtration (Exclusive feature). The first only of *two* endless filter curtains enters the oil bath. The second, "conditioned" by the special Staynew Air Jet Cleaners, runs semi-dry and prevents oil entrainment *absolutely.*
2. Air Jet Cleaners "Condition" Both Curtains (Exclusive feature). These cleaners remove excess oil with entrapped lint, dust, etc., from the first curtain, and in the second curtain keep oil accumulation at a point where entrainment cannot occur.
3. Direction of Curtain Travel is such that air leaves *clean* side always. The Staynew is the only mechanical type air filter with this feature.
4. Efficient, Specially Designed Woven Mesh Filtering Medium, Wire Cloth Protected (Exclusive feature).
5. Motor & Drive Mechanism cushion-mounted, silent.
6. Momentary Contact Switch for testing and checking curtain travel and compressed air control.
7. Shear Pin in Drive Shaft protects moving parts from accidental damage.
8. Control Mechanism arranged for mounting as integral part of filter unit or for remote control.
9. Gear and Roller Chain Drive. *No belts to slip.*
10. Nation-wide Service on both motor and controls.

Highest efficiency of any mechanical type automatic filter

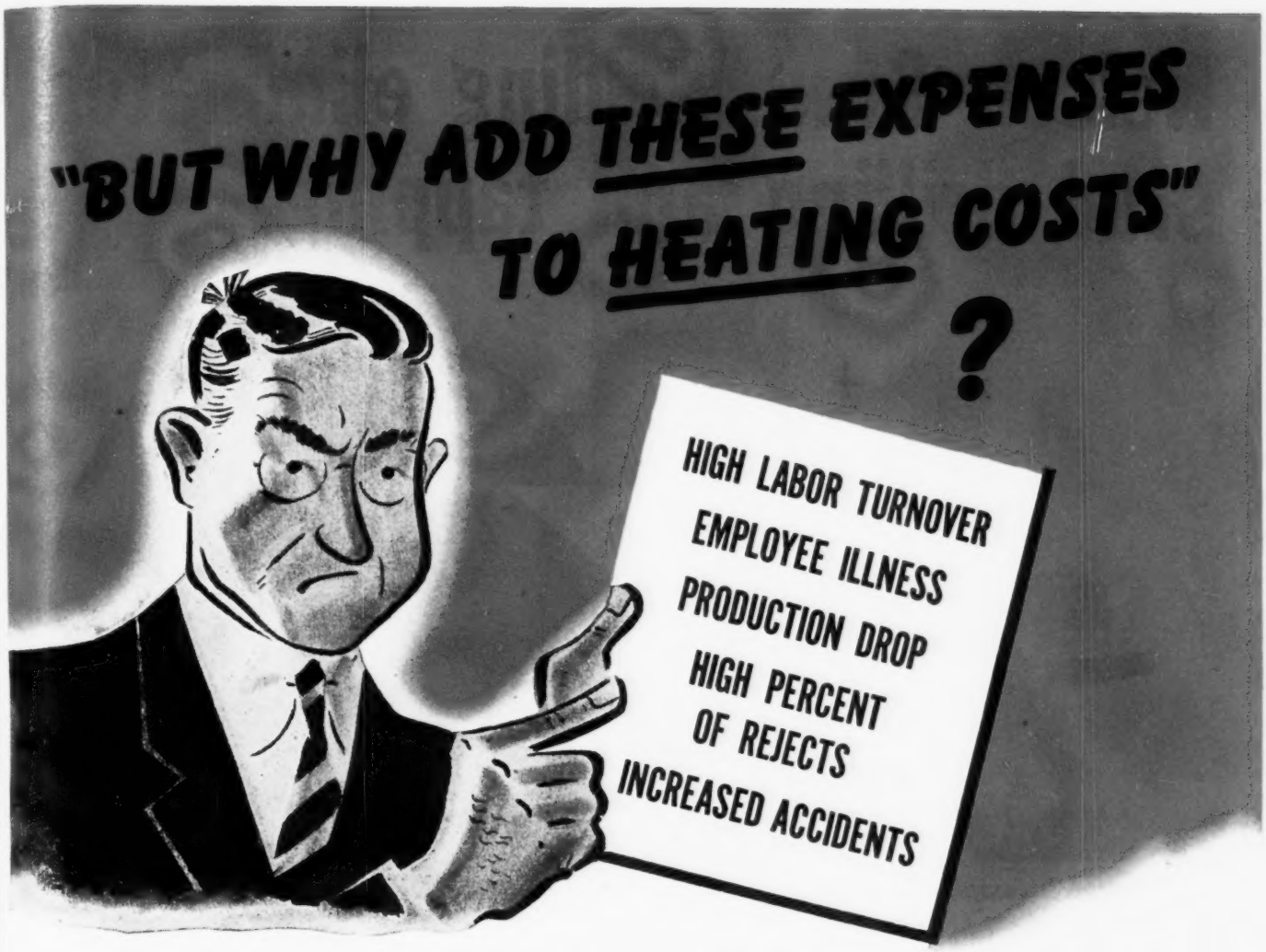
FULL INFORMATION ON REQUEST

DOLLINGER CORPORATION

FORMERLY STAYNEW FILTER CORP.

15 CENTRE PARK — ROCHESTER 3, N. Y.

STAYNEW FILTERS with PROTECTOMOTOR



ADDING these expenses to heating costs is one way of showing you just why Janitrol Gas-Fired Unit Heaters should have an important place in your postwar planning.

Take "labor turnover". It stands to reason that inadequate, uncomfortable heating has been at least a contributing factor in causing employees to change jobs. Keep them warm and comfortable and you'll be helping to *keep* them!

Employee illness and production drop-off go hand in hand. And, of that employee illness, probably a high percentage is caused by faulty plant heating.

Rejects and accidents, too, come as a result of poor heating. An employee trying to keep warm simply can't give close attention to the work he is trying to do.

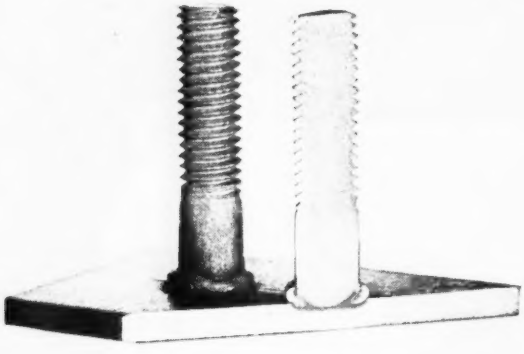
So, when you're tempted to cross off "an improved heating system" from your postwar plans because you think you "can't afford it", remember, there are many hidden expenses which come as a *direct result* of antiquated, ineffective heating systems.

And remember, too, that for long-lasting performance, trouble-free operation, and healthful, satisfying heating comfort for your employees, you can't beat *Janitrol.* For Surface Combustion engineers have built more advantages into Janitrol than may be found in any other unit heater. For complete information on the Janitrol line, write Surface Combustion, Toledo 1, Ohio.

Janitrol

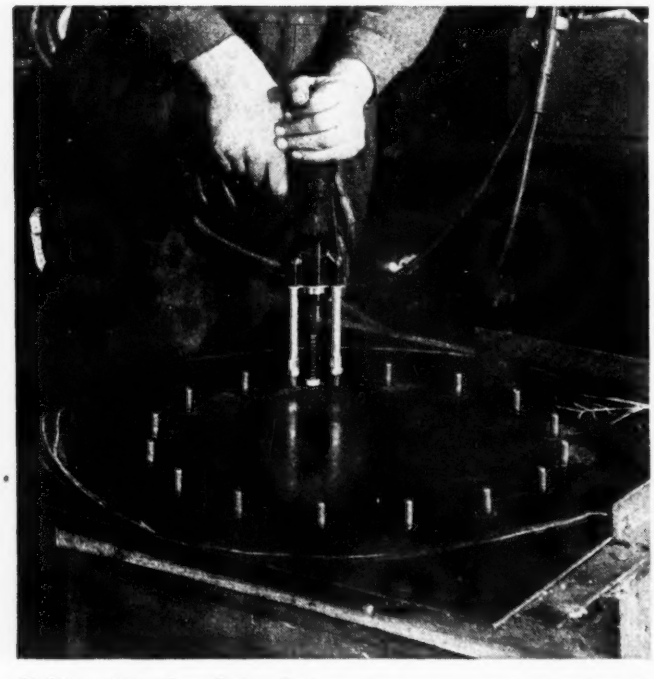
GAS-FIRED HEATING EQUIPMENT

Nelson Stud Welding eliminates stud drilling and tapping!



Cutaway view of end-welded stud shows how stud is completely fused with metal in ½ second.

Photographs by courtesy of Herbert H. Davis Co., Cicero, Ill.

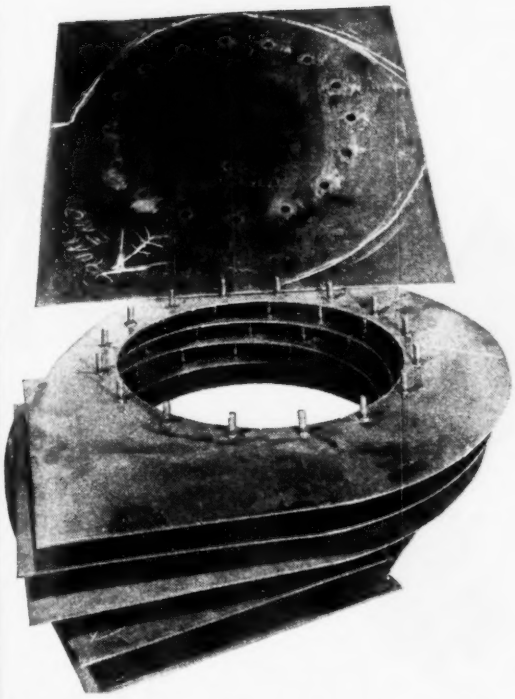


Welding studs through template produces accurate duplication of parts. Studs are welded through guiding template to work underneath. The operator loads a stud into the gun chuck, inserts it into the hole and pulls the trigger. Welds are *automatically* made in an instant.

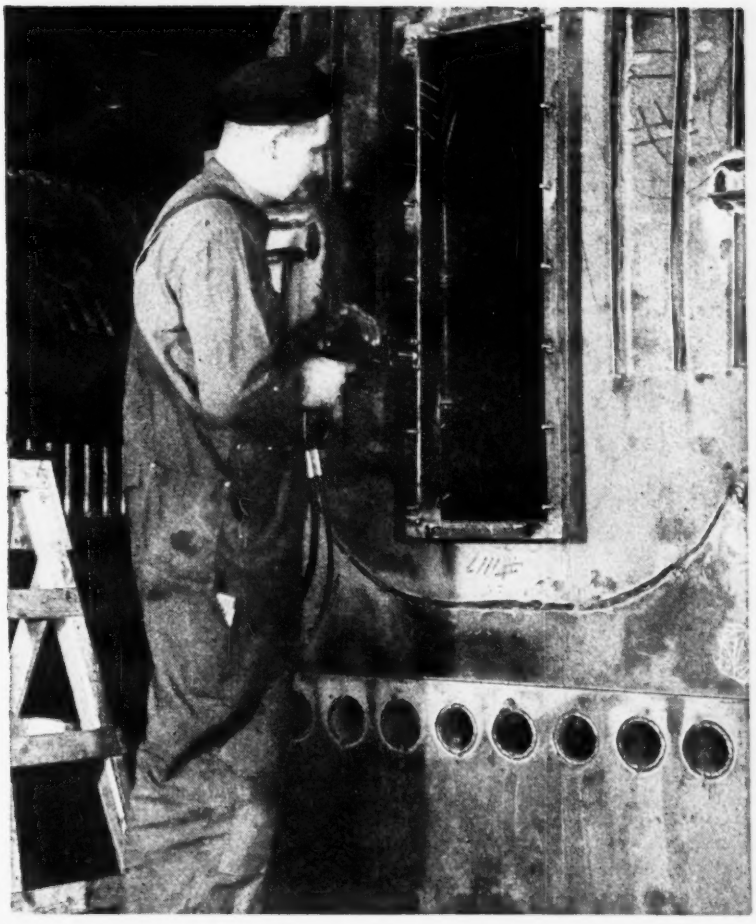
The Nelson Arc Stud Welder saves time and material because it secures studs without drilling and tapping holes. The manufacturing of air-conditioning equipment and industrial furnaces at the H. H. Davis Co. is a fine example of a typical industrial application.

The welds made with Nelson studs result in uniform work with *complete fusion* between stud and metal. Thousands are now being used by more than 650 industrial plants and shipyards. Operators can average 500 to 1000 stud welds in eight hours.

Nelson Stud Welders are fully automatic and are completely portable . . . they may be operated as a production unit or as a portable hand tool.



A template is used in welding studs to parts. Studs are welded through holes onto casing, insuring accuracy of spacing. Nelson Production Stud Welding Units, welders mounted on pneumatic cylinders and arbors, are also used where continuous production of parts is required.



Inspection plates of all kinds are welded in any position with the portable Nelson welder. Light in weight and easy to handle, it may be used efficiently in any location. Welds produced are as strong as any hand-welding method—have consistent weld fillets.

Welding inspection covers of all types is an ideal stud application. Studs are welded at desired centers to cover flange and cover secured with nuts. No holes in casing . . . close tolerances held.

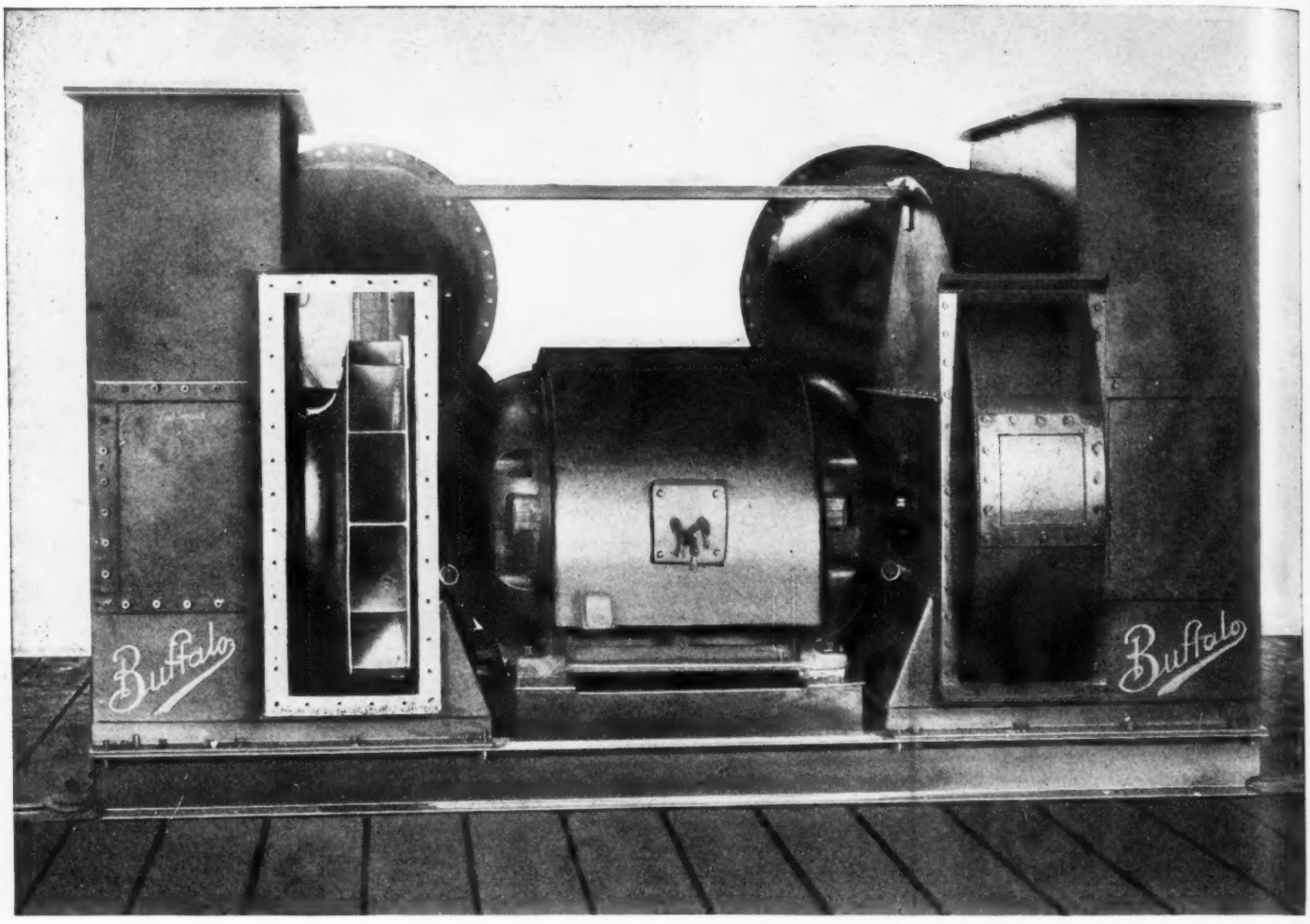
Welding inspection door on industrial furnace through template. All arc timing is automatically controlled, producing consistent welds. Write today for catalog and complete details.

For catalog and prices write to

NELSON SPECIALTY WELDING EQUIPMENT CORP.

Dept. H, 440 Peralta Ave., San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 So. Sixth St., Camden, N. J.



Experience "pays off" ~

Better engineering is always expensive. It costs more in salaries, more in overhead, requires more expensive equipment. In the long run, however, because the customer benefits, it is a good investment.

The fan pictured above, for example: Two units were required – one to deliver 88,000 cfm at 51" static pressure – the other to deliver 44,000 cfm at 102" static pressure. There is no volume market for such fans – nor any stock design which would give the desired results. "Buffalo" engineers, from accumulated experience, were able to design the practical heavy-duty unit shown above with minimum lost time and very satisfactory efficiency. One unit consists of two fans operating in series, delivering 44,000 cfm at 102" static pressure; the other unit consists of twin fans operating in parallel; – 88,000 cfm at 51" static pressure.

When you purchase fan equipment, be sure to get the benefits of Buffalo engineering. Sales representatives in all principal cities will be glad to make recommendations.

"Buffalo" "First For Fans"

BUFFALO FORGE COMPANY

480 BROADWAY • BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Fans for Industry

"City in the Sky"--the Mercantile Bank Building, Dallas, Texas. Youngstown Pipe used for plumbing, heating and air-conditioning. Architect, Walter W. Ahlschlager, general contractor, Henger Construction Co., plumbing sub-contractor, C. Wallace Plumbing Co. -- all of Dallas.

If Dallas depended on this Egyptian Chain of Pots

THE citizens of Dallas take justifiable pride in this new skyscraper . . . the 30-story Mercantile Bank Building.

Yet who appreciates that this "City in the Sky" was possible only because of the availability of modern piping systems--the only practical means to service every floor of its magnificent 30 stories with water.

Imagine what this building, housing thousands of workers, would be like with no water or modern heating facilities. Picture the impossibility of this structure in Ancient Egypt, dependent on the then ultra-convenient chain of earthenware pots to draw water from wells.

In order to live in cities, civilized men must have water close at hand . . . and to have water we must have dependable pipe . . . pipe low enough in cost so that it can be used plentifully, pipe durable enough that it will withstand the ravages of time and the hardships of extraordinary service. Steel pipe is the answer to all of these requirements.

The architect who specified Youngstown Pipe for this job and the contractor who bought and installed it, know of its enviable record in other outstanding installations.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

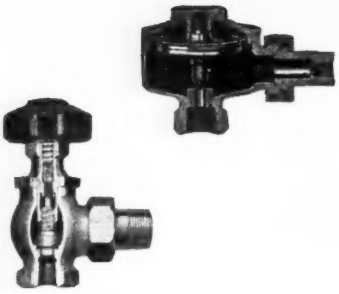
YOUNGSTOWN 1, OHIO

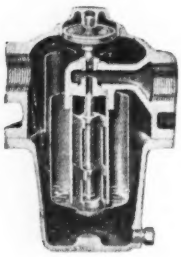
Manufacturers of

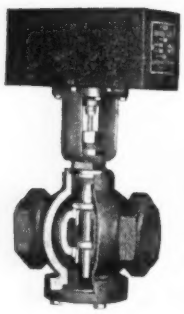
Carbon, Alloy and Yoloy Steels

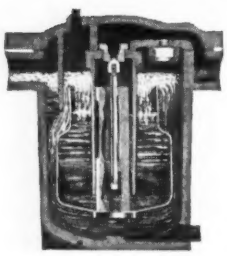
QUALITY YOUNGSTOWN SERVICE

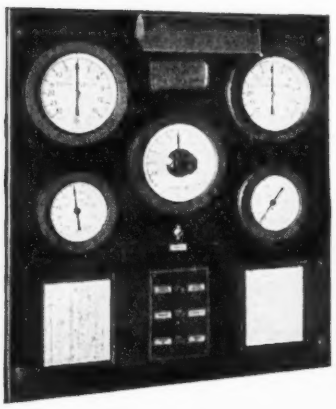
Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Coke Tin Plate - Electrolytic Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes.











Meet tomorrow's demands for heating comfort and fuel economy with

ILLINOIS

Automatic

Steam and Fluid Control Equipment

Demands for reconditioning, remodelling and new and better heating systems will be abnormally high when the restrictions of the past few years have been lifted. Prepare *Now*—Plan *Now* to meet these demands.

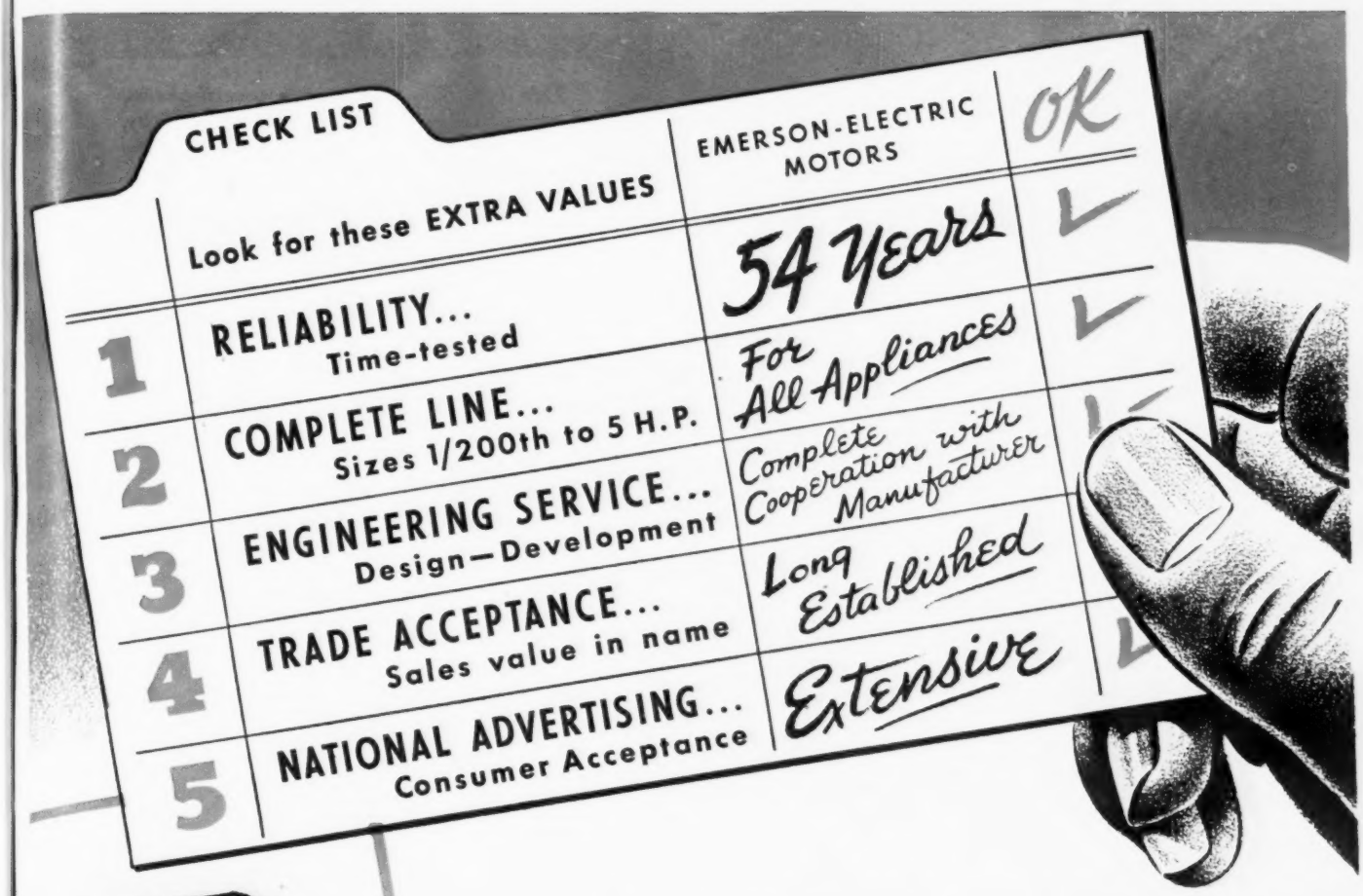
Illinois Control Equipment includes Combustion Control, Flow Control (electrical or pneumatic), Zone Control and a complete line of steam heating and power specialties for heating comfort and fuel saving and for industrial process control as well.

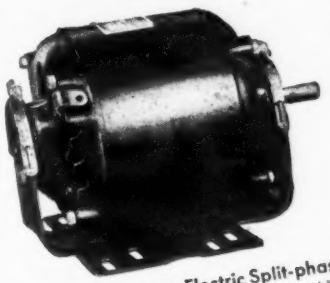
"ILLINOIS" is your logical, dependable source of supply for heating and power specialties that have been carefully engineered, thoroughly proved and have a performance record that is beyond question.

Our representative nearest you in our nation-wide service will give you full information.

Write for bulletins.

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO





Standard Emerson-Electric Split-phase Motor with resilient mounting. Also supplied with rigid mounting.

Thirty-seven years ago, 1908. A new day in home heating. An Emerson-Electric motor-driven blower is attached to a warm air furnace.

How to find extra values in ELECTRIC MOTORS

Many motors look alike, but there the similarity ends! The real difference is in the *extra values* that are so vital to the reputation of your product.

Tabulated above are five highly important background values to consider. It will pay you well to investigate them carefully—because, no matter how good your product may be, it is finally no better than the motor that drives it.

RELIABILITY—Time-tested . . . An important factor is this 54-year time-tested reputation for building motors for virtually all types of domestic and commercial appliances.

INVESTIGATE *the extra values* back of Emerson-Electric Motors. Give your products this extra *sales* value.

THE EMERSON ELECTRIC MANUFACTURING CO. • ST. LOUIS 3, MO.

Branches: New York • Chicago • Detroit • Los Angeles • Davenport

2

EMERSON ELECTRIC

MOTORS · FANS — APPLIANCES

This is No. 5 in a series of 6 Advertisements, setting forth values of the adequacy, simplicity, flexibility, dependability and economy of the Dunham Differential Vacuum Heating System.

DEPENDABILITY

The Dependability of the Rural Mail Carrier in Scorching Heat or Winter's Storm is Traditional

You take the dependability of The United States Mail as a matter of course. It is one of our American Blessings accepted as a commonplace in life.

We at "Dunham" like to think that another blessing in American life is the comfort and economy of Differential Heating and the confidence its performance, in all weathers, has established over almost two decades of service.

With Dunham Differential Heating you procure not only its noted fuel economy, its unvarying comfortable temperature in mild or frigid weathers, its minimized supervisory or maintenance requirements, but you secure those values, year after year in utter dependability.

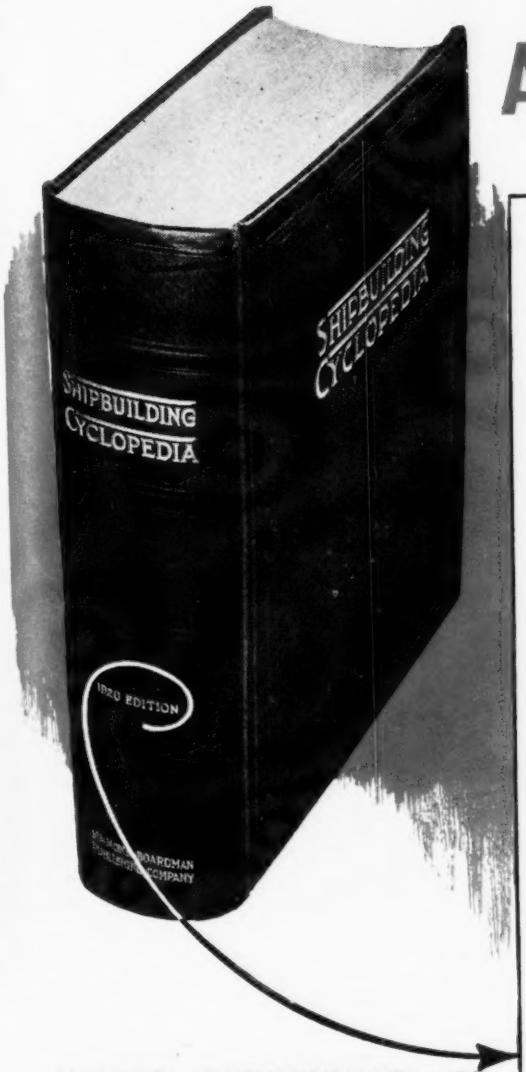
★

Records of more than twenty years of dependable service are available on Dunham Differential Heating Systems in all types of new and change-over installation buildings. For illustrated interesting Brochure No. 632 write to C. A. Dunham Company, 450 E. Ohio Street, Chicago 11, Illinois.

DUNHAM

DIFFERENTIAL HEATING

CHICAGO • TORONTO • LONDON



A QUARTER-CENTURY AGO

WING PIONEERED IN SHIP VENTILATION

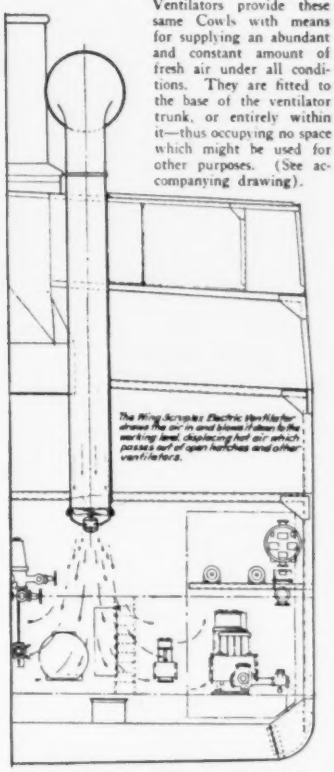
As shown by this page from the 1920 edition of Shipbuilding Cyclopedia, the Wing System of Ship Ventilation, by propeller fans installed in cowls, dates back over a quarter of a century.

Wing Scruplex Electric Ventilators

Wing Scruplex Ventilators vs. Cowl Ventilators

The amount of fresh air provided by Cowl Ventilators, commonly used for ship ventilation, is dependent entirely upon, the velocity and direction of the wind, and the speed and direction of the vessel. Therefore, it is quite obvious that with a "following wind" or when "hove to" or in port, they frequently fail to function, causing conditions below to become unbearable, and perishable cargoes to rot in the holds.

Wing Scruplex Electric Ventilators provide these same Cowls with means for supplying an abundant and constant amount of fresh air under all conditions. They are fitted to the base of the ventilator trunk, or entirely within it—thus occupying no space which might be used for other purposes. (See accompanying drawing).


The Wing Scruplex Electric Ventilator draws the air in and blows it down to the working level, displacing hot air which passes out of open hatches and other ventilators.

Typical Installation of Wing Scruplex Ventilator

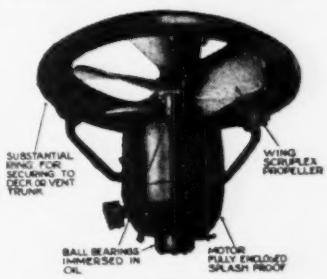
Over 750 vessels of various types, Pleasure Craft, War Ships, Cargo and Passenger Ships, are equipped with Wing Scruplex Electric Ventilators.

Features of Design

Wing Scruplex Electric Ventilators are especially designed for ship ventilation, therefore, light yet rugged construction, and proper protection from the injurious action of the elements, has been one of the prime considerations.

The propeller (screw design) delivers a solid column of air at high velocity.

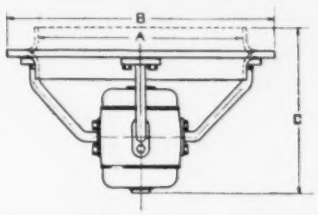
The Motor is splashproof and liberally designed for constant operation with a minimum of attention.


SUBSTANTIAL RING FOR SECURING TO DECK OR VENT TRUNK
WING SCRUPLEX PROPELLER
BALL BEARINGS IMMERSED IN OIL
MOTOR FULLY ENCLOSED SPLASH PROOF

Wing Scruplex Electric Ventilator

Engineering Data

The drawing and table below give general dimensions, capacities and speeds of the various standard sizes which will enable the engineer to select the unit best suited to each location.



Size	Capacity Cu. Ft. Min.	Speed Rev. Per Min.	Dimensions A	B	C*
10	1,100	2,000	10	12¼	11
13	2,000-2,500	1,500-1,750	13	16	12
17	3,000-4,500	1,150-1,750	17	20	14
22	5,000-5,900	1,150-1,750	22	26¼	14
25	6,000-9,100	1,150-1,750	25	29	16
30	7,500-12,500	700-1,150	30	35	19
36	10,500-15,000	600-850	36	41¾	21
42	14,000-24,000	500-650	42	47	25
45	19,000-30,000	450-700	45	50	29

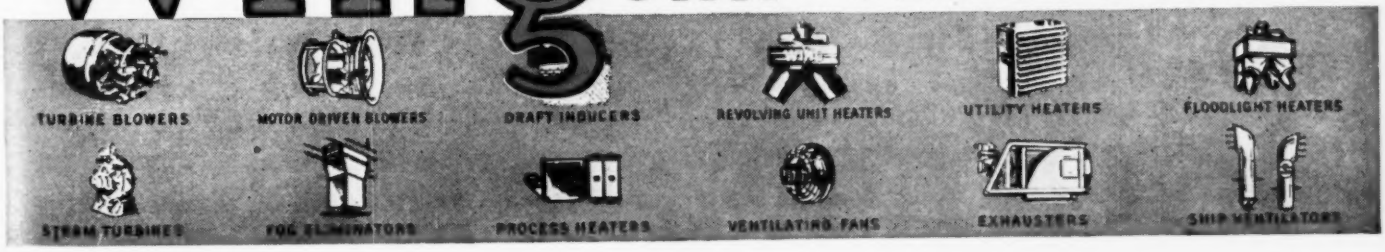
*Approximate.
Note.—Highest and lowest Standard Speeds and capacities are given above—Intermediate speeds and resultant capacities varying directly with the speeds may be furnished if occasion demands.

Among other products of the L. J. Wing Mfg. Co. are Wing Turbine Blowers for Forced Draft, used extensively on oil burning ships.

L. J. WING MFG. CO.
352-362 WEST 13TH ST., NEW YORK, N. Y.
1053

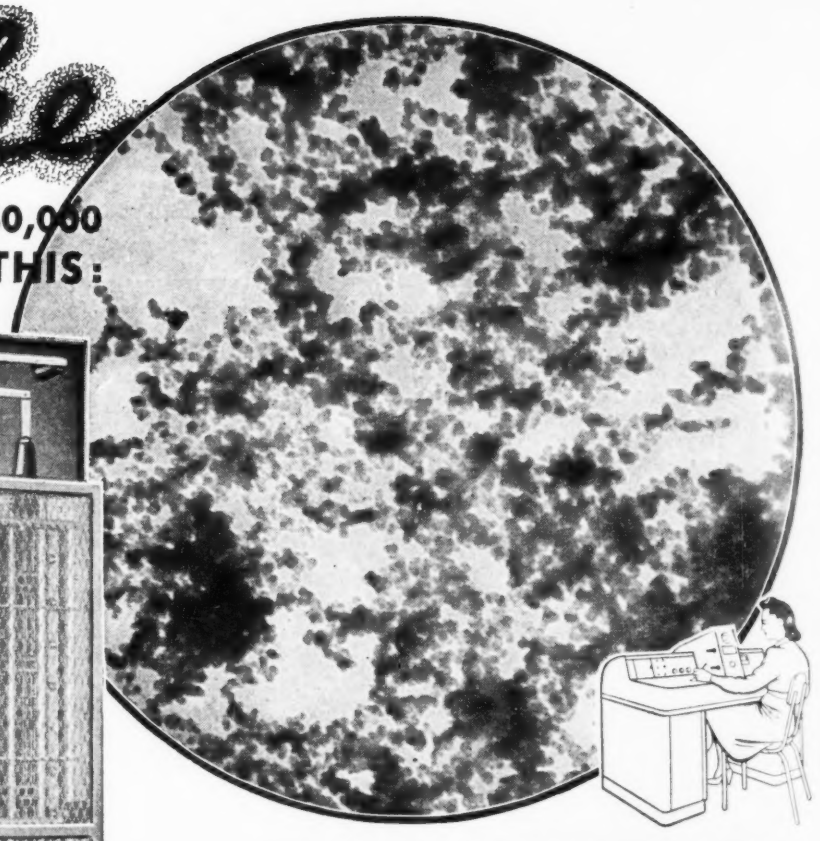
Note: Our present address is
158 W. 14th St. New York 11, N. Y. Factories: Newark, N. J.

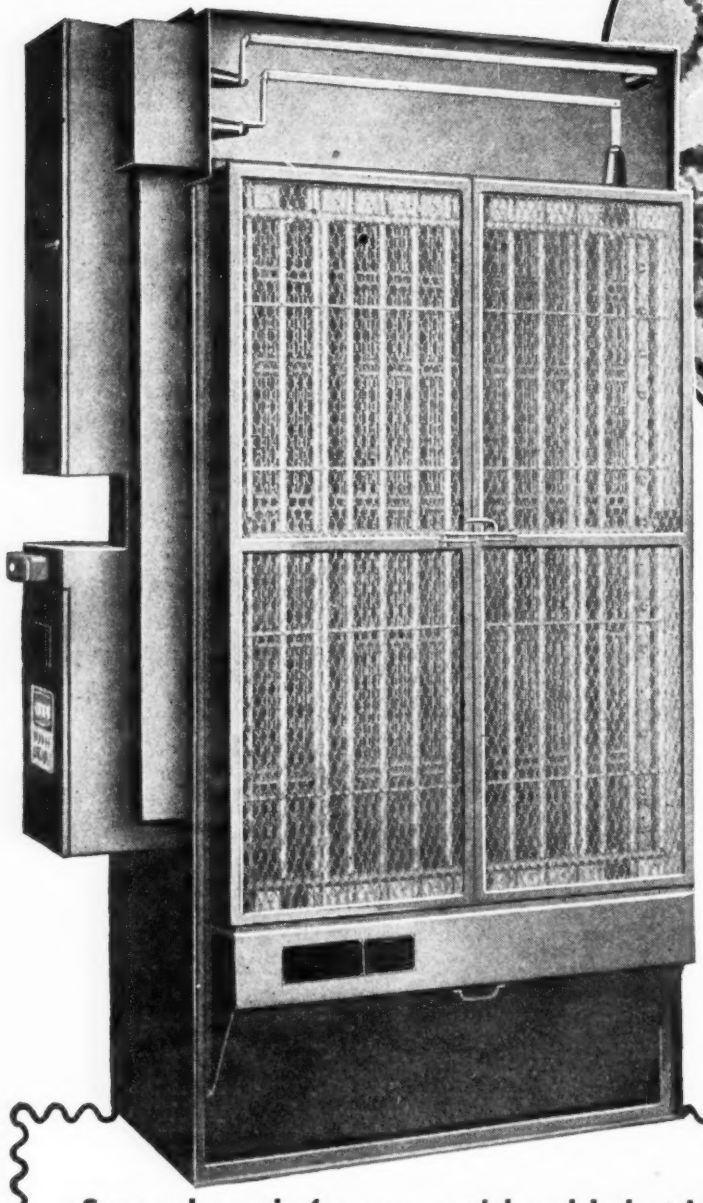
Wing SHIP VENTILATORS



Smoke

HAS TO BE MAGNIFIED 40,000 TIMES TO LOOK LIKE THIS:





. . . YET SMOKE AND OTHER FRACTIONAL MICRON-SIZE PARTICLES ARE REMOVED BY THE ELECTRO-MATIC WHICH PROVIDES SUPER-CLEAN AIR!

Only the new electronic microscopes, will show all the particles of dust that the Electro-Matic Air Filter will remove. By first giving dust particles an electrostatic charge, then attracting them electrically to viscous surfaces, the Electro-Matic makes possible a degree of cleanliness in plant atmospheres that is unapproachable by other means. In addition, this equipment is rugged, automatic and self-cleaning (an exclusive AAF development) assuring continuous operation at peak efficiency.

Super-clean air for commercial and industrial concerns is guaranteed by the Electro-Matic

The use of filtered air to protect the health and comfort of employees is not just altruistic but a sound business investment. A large industrial insurance company estimates the time lost by employees due to colds and other dust borne respiratory reasons is costing business millions of dollars each year. This does not take into consideration the indirect losses resulting from production slow down, costly mistakes and the unavoidable waste due to inexperienced operators replacing absent key workers. Nearly every type of industrial plant and commercial concern is represented among the users of AAF equipment. For complete information on the Electro-Matic Air Filter send for Bulletin 250-D.

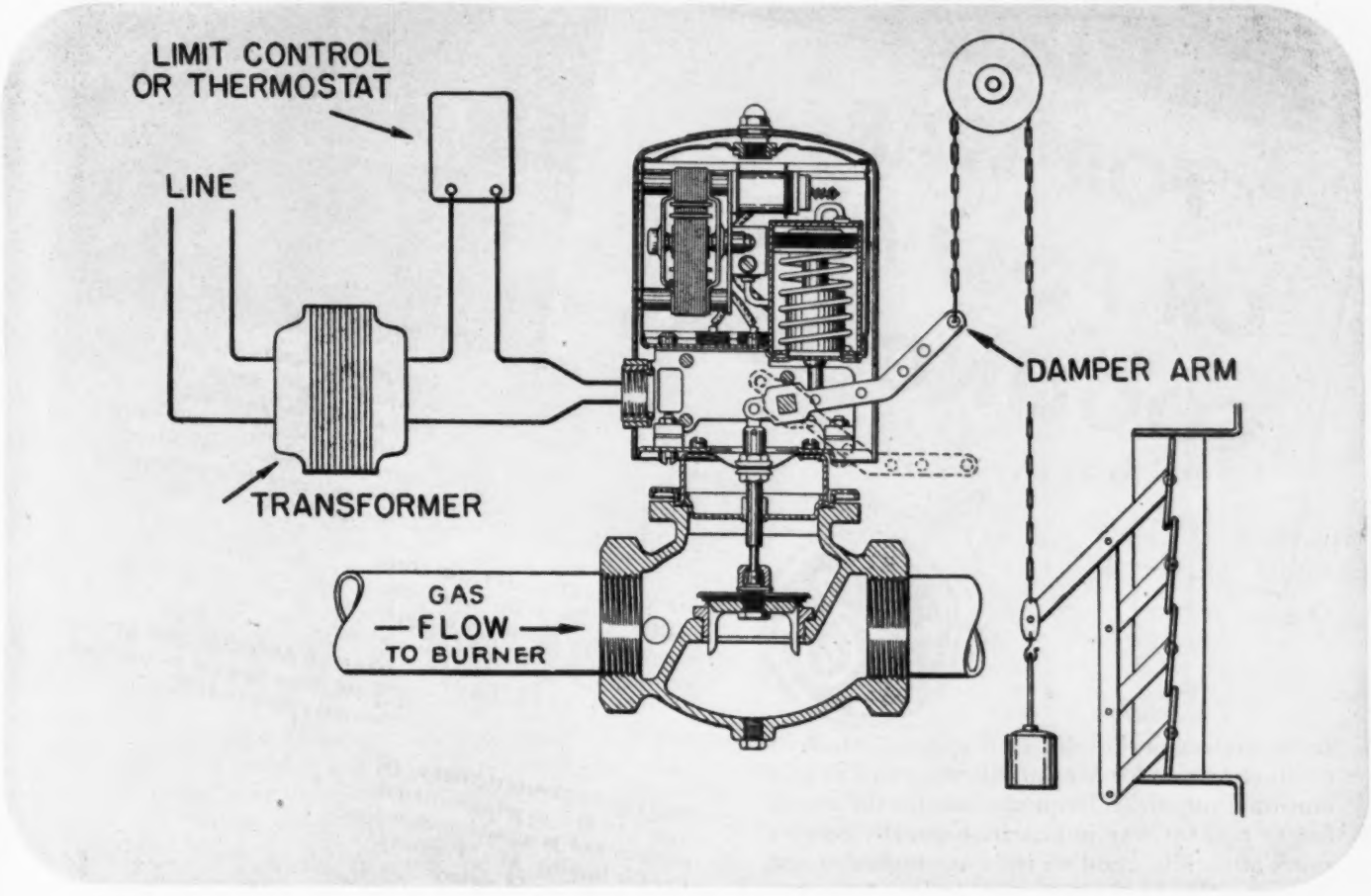
AMERICAN AIR FILTER COMPANY, INC.
Incorporated
294 Central Avenue LOUISVILLE 8, KY.
In Canada: Darling Brothers, Ltd., Montreal, P. Q.

AAF **ELECTRO-MATIC** THE SELF CLEANING ELECTRONIC AIR FILTER

GENERAL CONTROLS

HYDRAMOTOR GAS VALVE

With Ample Damper Power!



● The satisfactory control of coke gas, and other extremely gummy gases, often demands more power than ordinary motor valves can deliver.

General Controls Engineers developed the G-1-5 HYDRAMOTOR Gas Valve . . . a hydraulic motor operated valve with ample power to operate all types of louvres or secondary air doors. Opens 8 to 10 seconds; closes 2 to 3 seconds.

This powerful motor valve is two-wire, current-failure, and entirely conforms to simplified two-wire control circuits. All parts are *sealed in oil for life*, thus insuring a lifetime of efficient trouble-free service.

The G-1-5 handles natural, manufactured and liquefied petroleum gases for central heating furnaces, unit heaters, hot water and steam boilers; also for heat treating furnaces, kilns, core ovens, driers and other industrial applications.

A manual opening device with automatic recycling feature is provided for use in case of current failure. Available ¾" to 2½" I.P.S., low or line voltages, all frequencies.

For complete specifications on motor-operated and other automatic controls, write Factory Branch or Distributor nearest you for Catalog 52B, or to

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIF.

BRANCHES: ATLANTA • BOSTON • CHICAGO • KANSAS CITY • DALLAS • DENVER • DETROIT • PHILADELPHIA • NEW YORK • CLEVELAND
SAN FRANCISCO • HOUSTON • *DISTRIBUTORS IN PRINCIPAL CITIES.*

FOR WAR... OR POSTWAR... COOLING JOBS

... TURN TO G-E

CONDENSING UNITS: Rugged and compact, in wide range of standard sizes from 1/6 to 125 hp for operation in single or multi-stage systems. Designed to obtain and retain refrigerant temperatures as low as -130°F.

EVAPORATIVE COOLERS AND CONDENSERS: "Built-Up" unit construction for flexibility of application and ease of cleaning.

HEATING AND COOLING COILS: Wide range of sizes to meet all normal requirements.

INDUSTRIAL CONDITIONERS: Of from 5 to 30 tons refrigeration in cooling, and comparable capacities for heating. For "Freon-12" refrigerant or cold water.

In no prewar period did G-E approach today's production rate for Air Conditioning and Refrigeration Equipment. Requirements for the armed forces and for war industries naturally receive every attention...and we welcome inquiries and opportunities to serve you on such problems.

But we can help with your postwar problems too.

For G-E faces no long and difficult period of reconversion to peacetime products. The equipment now being made in record-breaking volume is exactly the equipment you will specify for civilian installations in days ahead—and the very volume of our production today is promise of its early availability for peacetime uses.

So...may we offer G-E "know-how," G-E experience, G-E engineering talent, in helping you plan, lay out, and specify systems or equipment ... for commercial or industrial requirements large or small? Take your problem to our nearest office ... or write to *General Electric Company, Air Conditioning Department, Section* 5915, *Bloomfield, New Jersey.*

EXCEPTIONAL TRIBUTE TO G-E QUALITY

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1 Though the street outside is stifling,
Inside Heatter's store it's worse.
Myrtle, in no mood for trifling,
Hastens out with tight-closed purse.

2 In McCool's the fagged-out lady
Trades her frown in for a smile.
Air that hints of palm trees shady
Bids her stop and shop a while.

3 End that long "war of attrition"—
Don't send folks out with a grouse!
Keep your air in peak condition—
Modernize — with Westinghouse!

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They're learning to depend upon Westinghouse and its years of pioneering research and engineering experience — for correct air conditioning . . . the scientifically-engineered blending of correct temperature, humidity, circulation and air cleanliness.

Westinghouse Authorized Contractors will be helping them get it. Will you? For information on available franchises, phone your nearest Westinghouse office, or write Westinghouse, 150 Pacific Avenue, Jersey City 4, N. J.

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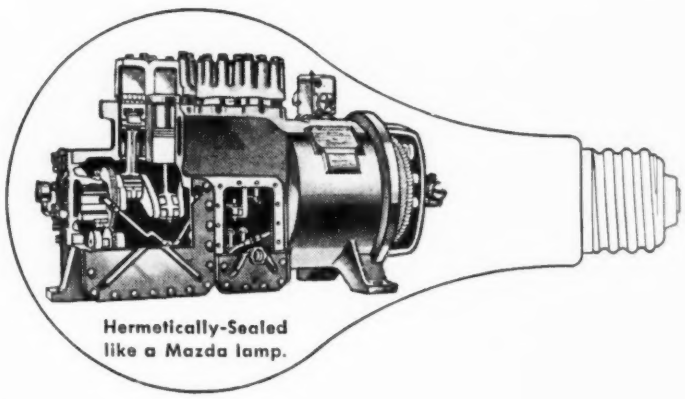

Hermetically-Sealed like a Mazda lamp.

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PLANTS IN 25 CITIES . . OFFICES EVERYWHERE

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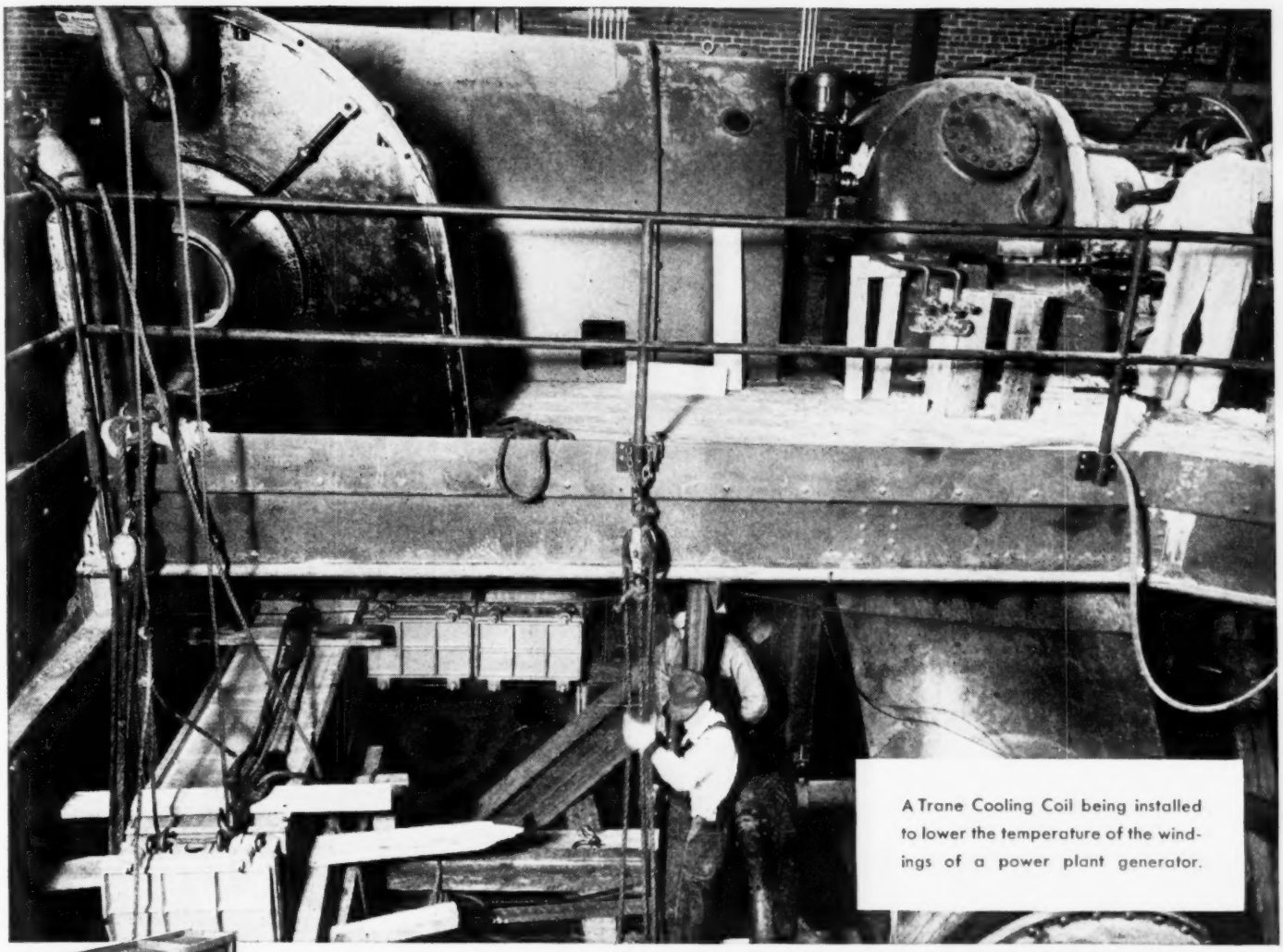
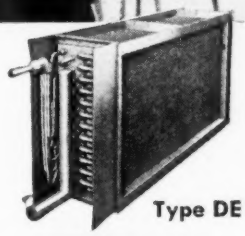


A Trane Cooling Coil being installed to lower the temperature of the windings of a power plant generator.



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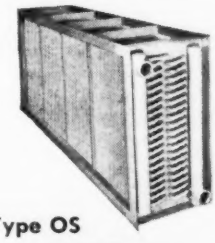

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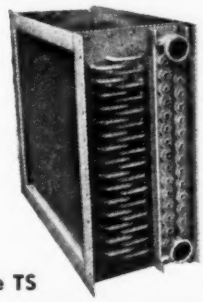

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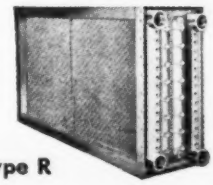

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THE HEAT REMOVER THAT SOLVES A THOUSAND COOLING PROBLEMS

Trane provides a Cooling Coil for every process and comfort application

• By removing heat Trane Cooling Coils do a multitude of temperature lowering jobs. Best known is their task of extracting heat from uncomfortable air for human comfort. But with that their job just begins.

They cool the windings of generators which might otherwise over-heat and burn out. They cool and condense gas in electric furnaces to prevent oxidation in such processes as copper brazing and bright annealing. They help to make better bread by removing heat from the loaf as it comes from the oven. They cool the oil that cools power transformers. They remove the heat from jacket water of diesel engines. They help make radio transmission possible by cooling the electric tubes used in broadcasting. They dissipate the heat of compression in large central air compressor systems. They even keep milady's fur coat in tip-top shape when she stores it for the summer at the furrier.

These are but a few of hundreds of applications of Trane Cooling Coils for cooling and dehumidifying air and other gases and for cooling liquids. Whether encased in an air conditioning unit, evaporative condenser or cooler, product cooler used separately, or incorporated in the machinery of others, Trane Cooling Coils provide for the maximum transfer of heat.

Trane Cooling Coils are available in four types for cooling with chilled water, cold well or municipal water, or any direct expansion refrigerant. Coils can also be provided for raw water from river, lake or pond, for circulating oil, glycol, or other viscous fluids.

Water coils may be furnished with positive drainage features that will prevent freezing and with removable headers to facilitate tube cleaning.

If you have a cooling problem, whether for comfort or process, call on Trane first. Either contact the Trane branch office nearest you, or write for Trane Catalog DS-365.

Also write for your copy of the new TRANE POSTWAR PRODUCTS BULLETIN.

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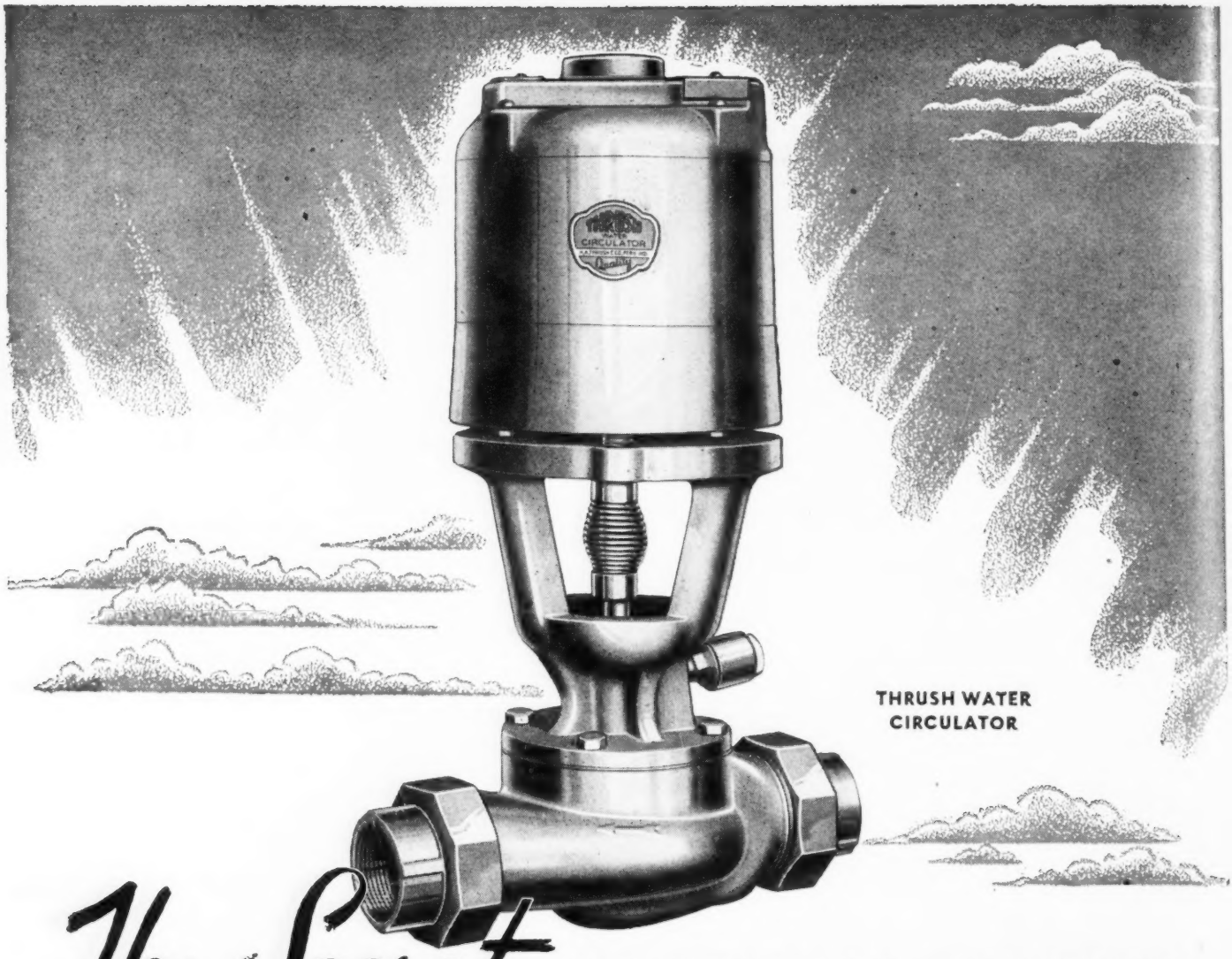
AIR CONDITIONING · HEAT TRANSFER · AIR HANDLING EQUIPMENT



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The Secret OF HEATING ECONOMY

THRUSH *Forced* CIRCULATION

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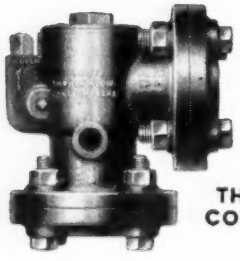
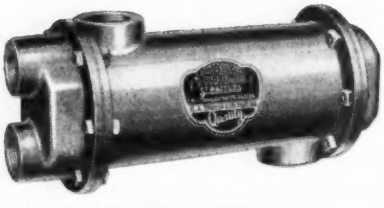


THRUSH FLOW CONTROL VALVE



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IN ALL the post-war dreams there's one feature you always find . . . completely automatic heating. And it's one feature that's already a reality! Thrush Forced Circulating Summer-Winter Hot Water Heat is Tomorrow's heating system, here today. Are you telling the people of your community its advantages of greater economy, real home comfort and year 'round Domestic Water supply? Are you getting it drawn in the blueprints and written into the specifications of the homes being planned? Are you recommending it for modernization work now? These are profit opportunities you should not overlook. If you are not familiar with Thrush equipment, see your wholesaler today or write Dept. D-5. for more information.

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Summer-Winter Hot Water Heat!

Guide to GOOD SHOP PRACTICE

USE SUPERIOR **FOR—**

Use SUPERIOR GALVANIZED *for* a time-saving, work-saving sheet. It is uniformly tempered for good workability. Its zinc coating has an unusual ability to withstand forming operations without flaking or peeling. It solders well, handles well. It's a quality sheet through and through.

USE CHECKER COAT **WHERE—**

Use CHECKERCOAT *where* you want smart appearance. It is a handsome sheet, galvanized in bright, checkered squares to add extra value to jobs where appearance is important. Like all Continental-Superior galvanized sheets it is made of open hearth steel and coated by the Superior Process.

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Use COPPERIOR *when* rust resistance is an important factor. It is made of copper-steel for greater resistance to rust and corrosion.

Both *The Superior Sheet Steel Company* and the *Continental Steel Corporation* produce these three well-known galvanized sheets. Ask your jobber about them today.

THE **SUPERIOR**
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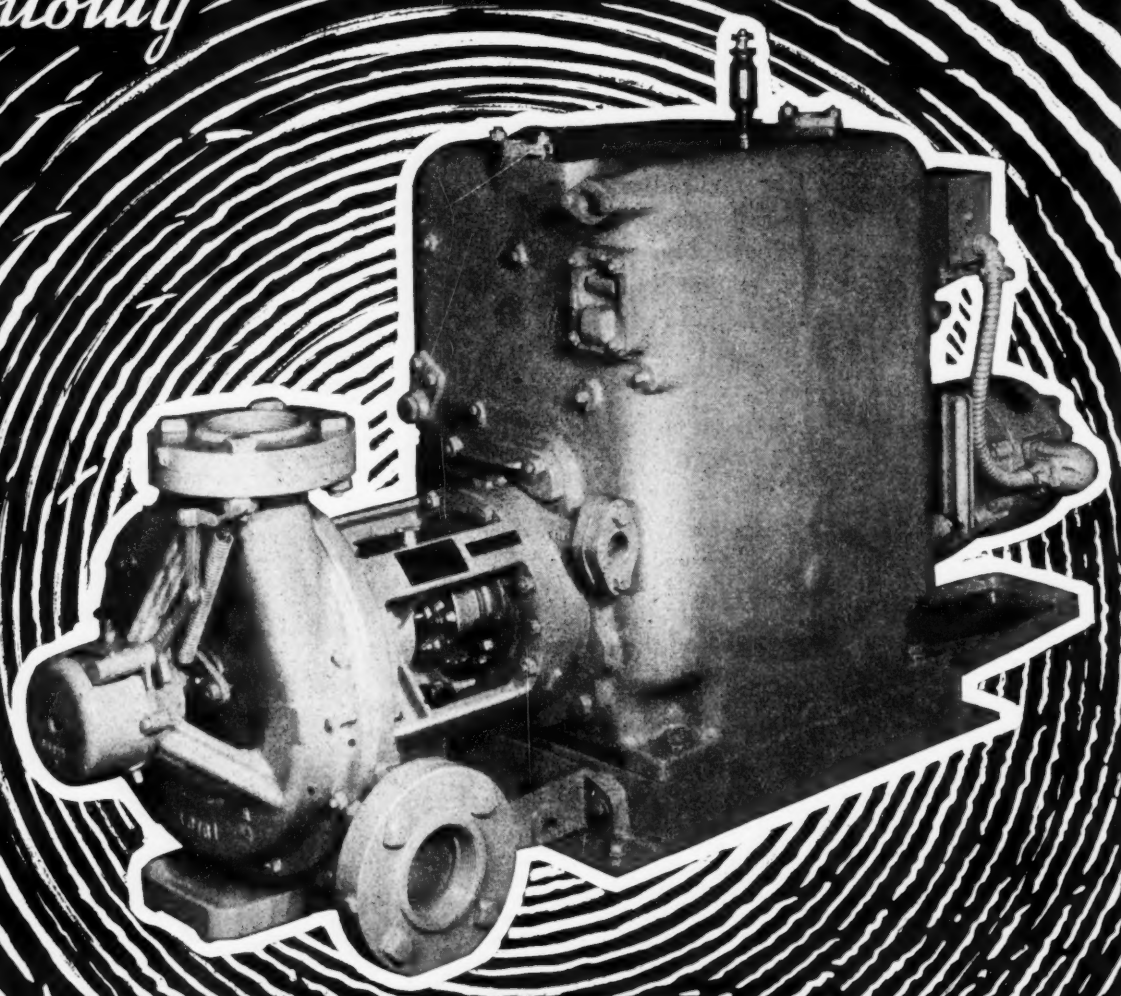
PRODUCERS OF STEEL SHEETS, including SUPERIOR Galvanized, Tite and Extra Tite Coat Galvanized, CHECKERCOAT, LASTI-KOTE, COPPERIOR (copper steel base), SUPERIOR Galvannealed, SUPER METAL, SUPERIOR Long Ternes (drawing quality), Hot Rolled Annealed, Hot Rolled Annealed Pickled, Pickled Blue, Deoxidized, and Standard Types of Galvanized Formed Roofing.

DIVISION OF CONTINENTAL STEEL CORPORATION • GENERAL OFFICES, KOKOMO, INDIANA

Centralized Heating Economy



A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
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HEATING AND VENTILATING

Your MERCHANT MARINE

WHEN peace comes, it is already clear that the manner in which international commerce is handled will go a long way toward maintaining that peace.

Already under scutiny are the possible effects that assumption of world maritime leadership by the United States may have on world commerce. By virtue of building a wartime Merchant Marine that will provide a merchant fleet of 50 million tons, the leadership is implicit, and an adequate policy to govern its operations is the subject of growing discussion.

The probable size of our post-war fleet places us in undisputed leadership from the standpoint of size, with more tonnage than the rest of the world combined. It is the policy that shall govern allocation, disposal and use of this tonnage that is concerning the Maritime Commission, the Congress, the Administration and the maritime nations of the world.

The Maritime Commission believes that National Maritime Day, May 22, is an appropriate occasion to launch further discussions that may help to outline a workable maritime policy. "It's Your Merchant Marine" will be the central theme of meetings and celebrations across the country May 22.

To those of us not engaged directly in shipping "It's Your Merchant Marine" should mean that no matter how far from the sea we may be, or how seemingly remote our interests are from ships or foreign trade, nevertheless our welfare is touched upon by the activities of a sound merchant fleet. To the manufacturer who fabricated the 10 to 15% of our production that was exported in the years before the war, an established Merchant Marine means an opportunity to double or treble that portion of his production. A well-balanced fleet also means that the imports of raw materials and of foodstuffs that cannot be grown on our farms will be brought to our own shores in our own ships under our own control, to the end that our manufacturing processes and our standard of living can be integrated to our needs.

In cooperating with the celebration of National Maritime Day, HEATING AND VENTILATING presents, starting on the next page, an article dealing with comfort air conditioning on post-war merchant vessels.

Your Merchant Marine Will Be Comfort Air Conditioned

JOHN W. MARKERT
Chief, Heating and Ventilating Branch, U. S. Maritime Commission

JUST as World War I gave impetus to the general use of mechanical ventilation, the end of World War II will bring with it great advances in air conditioning. War has a tendency to lower standards of living. While under normal conditions, the advance of living standards may be imperceptible, the reduction due to war becomes very evident. This consciousness causes a reaction which tends to override the normal curve of progress, but which finally will coincide with the normal trend, if conditions are stabilized for a period of time.

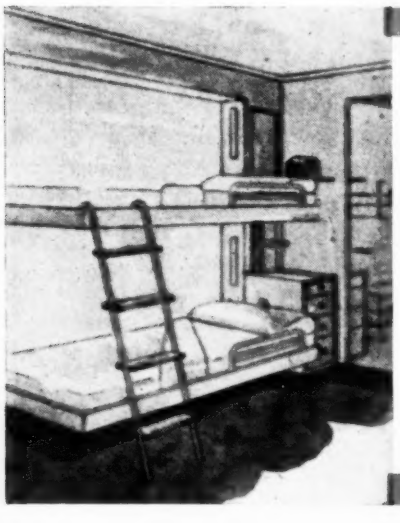
It is natural and proper that human comfort should be considered subordinate to the urgent requirements of military forces in times of war. However, while people accept the resulting discomforts, they are definitely conscious of them. Air conditioning has been one of the prime, if not the prime, comfort items, the absence of which has been seriously felt. Complete air conditioning has become a commodity rather than a luxury in all forms of transportation. Thus, the air conditioning industry for some time at least will have to devote its time to supplying the demand, rather than selling itself.

These general remarks fully apply to our merchant marine. Strangely enough, the necessity of air conditioning has been imprinted upon the minds of men in the shipbuilding industry by the discomforts they have encountered especially while patronizing other forms of transportation.

Development of post-war shipbuilding to date indicates the application of year-round air conditioning to certain quarters, as follows:

(1) All passenger dining rooms, except third class;

(2) All first and some tourist class accommodations (or their equivalent);



Pullmans lowered, showing berth light for each passenger and drop shelf for upper berth.

(3) Most public spaces, except large ones designed to be open during fair weather. The treatment will in general depend on the requirements of the trade;

(4) Crew and officers' messrooms and recreation rooms where below decks. This is common to passenger vessels;

(5) Captain's and chief engineer's staterooms and offices on passenger vessels;

(6) Crew and officers' quarters on some passenger vessels, particularly those of vessels plying continually in hot climates; and

(7) Inboard spaces on passenger vessels occupied by the ship's personnel who serve passengers such as stewardesses, pursers, stewards, and concessionaires.

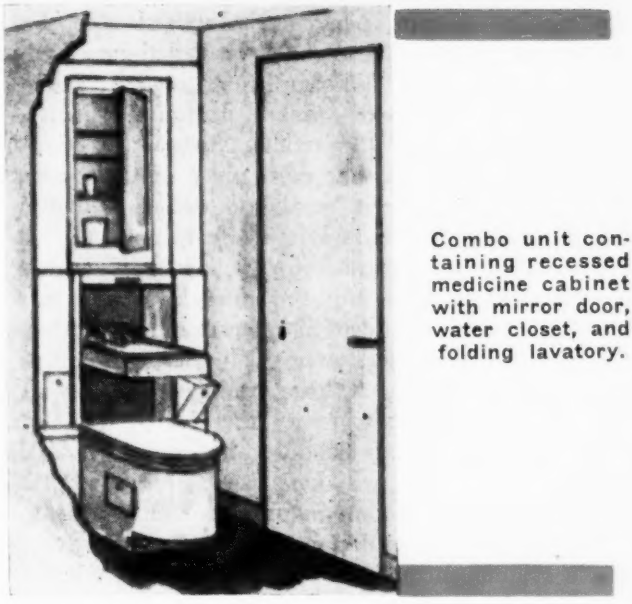
This list is not to be considered a radical step forward, because several passenger ships planned prior to the war were treated in this fashion. It is unfortunate, to say the least, that the war did not permit completion of at least a few of these vessels so that there could have formed more of a basis of experience for future designs.

There is much to be learned within the next few years before we can start to formulate definite fixed plans. Therefore, these years should be considered an educational period. The conservative conventional schemes should form a foundation which can be modified as time and experience dictate. A few of the many new ideas and theories have been presented from a more or less commercial point of view. This, of course, tends to distort the presentation, and, therefore, many claims must be thoroughly scrutinized before they can be fully accepted.

Outside and Inside Conditions

Outside design conditions will in a majority of cases be most severe when the ship is in port rather than at sea. There are certain inland waters which may be considered exceptions, and allowance must be made for these when they occur in the vessel's itinerary.

Aside from the normal run, certain ships are occasionally required to make off-season cruises, during which they may encounter more severe heating and cooling loads. Some vessels may not encounter cold weather on their regular run. Nevertheless, it is not considered advisable to design for too high an outside heating temperature because the difference in cost is insignificant. Similarly, it is not particularly important to design for extremely low outside temperatures, because steam at higher pressures than the design value is available should unusually severe weather be encountered.



Combo unit containing recessed medicine cabinet with mirror door, water closet, and folding lavatory.

Summer outside conditions of 95F dry bulb and 78F wet bulb have been used for North Atlantic runs. Conditions of 95F dry bulb and 80F wet bulb are used for semi-tropical runs, and 95F dry bulb and 82F wet bulb for tropical runs. As previously mentioned, the design conditions are primarily based on the port conditions.

A winter outside temperature of 0F dry bulb is used for vessels designed for North Atlantic service, while a 20F dry bulb outside temperature is used for vessels encountering only moderately cold weather in the normal service.

Inside design conditions for cooling have not been firmly established, except for dining saloons, which are designed for 80F dry bulb and 50% relative humidity. The same conditions have also been used for other public rooms. However, since the public spaces may frequently be entered directly from the outside or other non-air conditioned spaces, it appears that a higher dry bulb temperature and lower relative humidity may prove more satisfactory.

Inside design conditions for staterooms and similar small spaces have varied considerably. The differences have been more or less due to precedence and varying degrees of conservatism. In several instances, conventional land practice has some bearing on the subject. A certain amount of conservative experimenting is being done in an effort to determine the economical point of operation.

Considering the fact that sea conditions are less severe than those in port, it appears that effective temperatures on the border or slightly above the summer comfort zone should prove satisfactory. Furthermore, bracket (wall) fans are always provided to supplement the air conditioning systems serving staterooms. It is also felt that the type of air conditioning system provided should be kept in mind when specifying inside design conditions for comfort cooling. Outside design conditions should also be considered, because over conservative design can easily result, unless the relationship is kept in mind.

One group of ships has been designed for a North Atlantic run with an 85F dry bulb and 50% relative humidity (77.5F effective temperature). While the effective temperature appears exceptionally high, it was chosen on the basis of the operator's request for "a little cooling," and the fact that excessive cooling might be more severely criticized than undercooling in this particular trade.

A *second group* of vessels operating in semi-tropical zones is being designed for an effective temperature of 74F. Several types of systems will be used, and the relation of dry bulb to relative humidity will vary with the characteristics of each type of system.

A *third group* of vessels, which will operate in semi-tropical and tropical zones, is being designed for an effective temperature of 73F (80F dry bulb and 40% relative humidity). Certain peculiarities in the design of these vessels make it imperative that the inside design conditions should not be taken as a precedent.

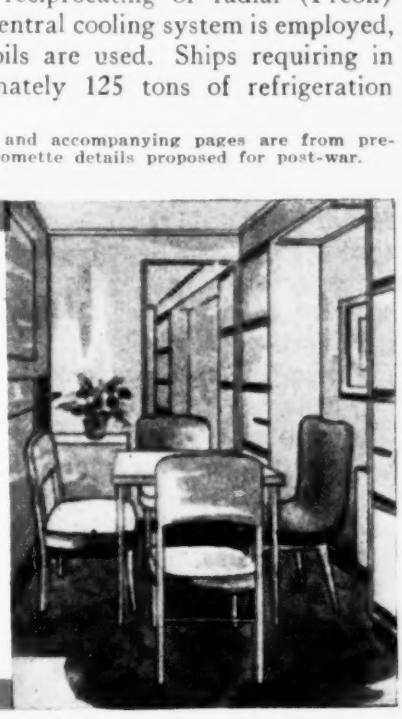
Design psychrometric conditions used to date obviously are based on the meager data available. It is believed that in many cases oversized equipment will be provided in order to insure satisfactory results. Needless to say, time will make available more accurate data which will enable the engineer to determine the requirements more scientifically. It is hoped, however, that the extra conservative design conditions which may be used at present will not be adhered to as a precedent once adequate information becomes available to justify a somewhat less conservative approach.

Types of Refrigeration Systems

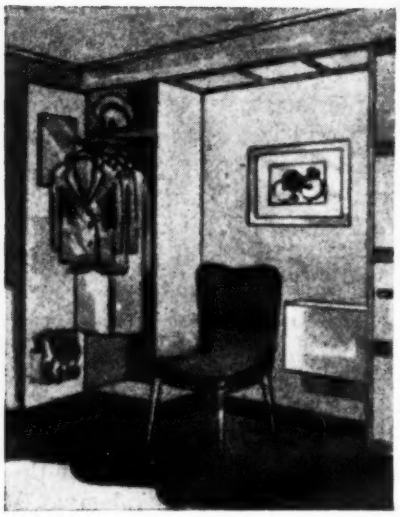
The kind of refrigeration equipment chosen for a particular vessel depends on the same factors which would govern the selection on land. Size of refrigeration load, concentration of treated spaces, nature and periods of occupancy, source of power, condenser circulating water temperature, and similar factors must be considered.

Small vessels carrying less than fifty passengers will probably use reciprocating or radial (Freon) compressors. If a central cooling system is employed, direct expansion coils are used. Ships requiring in excess of approximately 125 tons of refrigeration

Illustrations on this and accompanying pages are from preliminary sketches of roomette details proposed for post-war.



Pullmans stowed, bridge table and chairs set up. Note full length mirror on bathroom door.



Wardrobe for each passenger, equipped with shelf, sliding clothes rod, shoe rack and mirror.

will probably have centrifugal compressors. Larger tonnages to date have also used centrifugal machines although steam-jet refrigeration may still prove practical if manufacturers of this type machine will investigate its full possibilities. The two essential prerequisites of the steam-jet, cheap steam and condenser cooling water, are certainly available, and the simplicity of principle and operation is attractive, to say the least. Direct turbine-driven high speed centrifugal compressors, utilizing high pressure steam, however, appear to be most favorably received so far. Naturally, when electrical energy is available, the motor drive has been preferred.

Many ships have considerable refrigerated cargo space. Undoubtedly, the type of equipment used for this application should be kept in mind when selecting equipment to be used for air conditioning. This consideration can reduce materially the overall cost, because a stand-by unit is always provided for cargo refrigeration. Also, most cargo systems are designed for handling hot cargoes, so that, during a considerable portion of the time, a large amount of the capacity is available for comfort air conditioning.

Features of Comfort Systems

Probably the most difficult problem to solve at present is what type of air conditioning system is considered best for staterooms and similar spaces. Large public spaces are conventional, both as to occupancy and treatment. Thus they may be treated according to reliable practice which has been established through experience. Unfortunately, or, from another point of view, fortunately, the satisfactory treatment of small spaces has not been so firmly established. The many angles which the engineer must consider, in determining the correct solution, are numerous.

Some of the more important factors which should be considered, in order of importance, are:

(1) Reliability and simplicity;
(2) Economic limitations;
(3) Operational peculiarities;
(4) Cost; and
(5) Space limitations.

Reliability and Simplicity

These factors should form the basis of any air conditioning system, particularly aboard ship, because trained personnel cannot be called in at any time to correct failures in complicated set-ups. Tricky control sequences and numerous manual changeovers usually prove impractical. Simple direct design, which provides that each piece of equipment stand on its own merit, is always easier to understand and operate. It is fairly safe to assume that the personnel of future ships will include an air conditioning engineer, but this does not mean that he will be able to keep in operation any system which proves theoretically correct in the design office. For the near future, at least, the air conditioning engineer must concentrate on the development of simple and reliable air conditioning equipment and systems. This alone will keep the ship's personnel busy without further complicating it with unnecessary refinements and maintenance. In other words, a simple system encourages proper operation, while a complicated one discourages it and finally ends by having many of the refinements disconnected or inoperative for some other reason.

Economic Limitations

These have and always will be an important consideration. The subject is one about which volumes can be written.

All of the popular systems used for ventilating and heating ships built prior to 1940 were designed to utilize as few automatic controls as possible, although according to the records the desirability for such devices existed prior to 1900. Nevertheless, it appears that experiences did not justify designing systems which depended on automatic controls for effective, efficient operation. As a result manual control was used almost exclusively. The predominant systems were the split system (direct radiation for heating and separate ventilation) and the dual duct system—frequently referred to as the "hit and miss system." One big advantage in both of these is that the heating can be adjusted without materially affecting the ventilation. In a similar fashion, a first class air conditioning system should be one which utilizes a maximum average volume of outside air. This is particularly true of ship systems because of the inherent air tightness of the structure and characteristic odors. For this reason, such systems should not depend on throttling of the individual room air supply to achieve temperature control either automatic or manual.

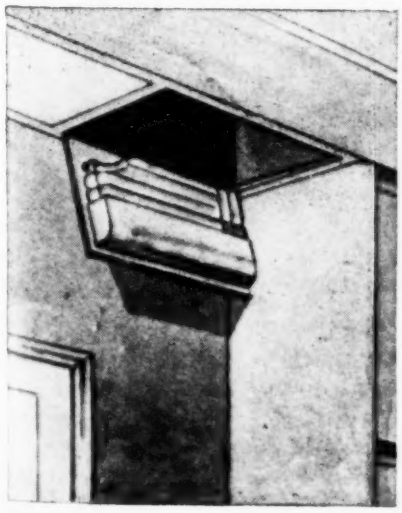
There is a trend to provide very small staterooms for certain trades, sometimes called roomettes, approaching Pullman compactness, and which have the refinement of private washing and toilet facilities. Being small, it is evident that the revenue obtained will be less than the more luxurious accommodations. However, it is absolutely essential that suitable air conditioning be provided to make them at all livable. The expense of providing separate heat exchangers, automatically controlled for each stateroom, whether it is large or small, has been questioned as not being economically justified. In many cases, those who bring up this question do so on the basis of their experience on land.

Small spaces of roomette type are particularly difficult to treat. First, they are almost always inboard and depend entirely on the air conditioning system for ventilation. Second, the compactness introduces a difficult problem of air distribution. Third, the room load always is fairly constant, because there is little or no exposed area. Therefore, some cooling is required a large percentage of the time, and such spaces cannot tolerate poor air conditioning.

Economic limitations should be determined on a comparative basis. As an example, the engineer should compare the cost of the air conditioning equipment with the cost of the room furnishings and decorations. Also, the treatment should be consistent with that used in other forms of comparable transportation. A ship may not be able to compete with the airplane and train on a speed basis, but certainly it can lead the field in providing comfort.

Operational Peculiarities

These exist in all air conditioning applications. To disregard them in shipwork would be disastrous. Several years ago, a survey was made to determine the percentage of time the air conditioning system of a certain building operated on cooling, simultaneous cooling and heating in various parts of the building, and heating throughout the building. The survey showed that for the particular locality, cooling was required about 50% of the time, simultaneous cooling and heating about 25% of the time, and heating about 25% of the time. A merchant ship spends most of its time at sea where conditions usually are temperate. About a third of the time, she is in various ports where more extreme climatic conditions are encountered. In these ports, too, she may encounter various climates. She may pass in and out of local warm conditions in a relatively short time, both at sea and coming into and out of ports. In other words, the ship does not have seasonal operation, nor is there any particularly convenient time when the system can be shut down for repairs and overhauling. These considerations are important in the design. They require that a system be capable of change-over from heating to cooling in a minimum of time and effort. Furthermore, these factors demand that equipment be selected and designed with the assumption that periodic maintenance is not always possible.



Concealed life preserver stowage rack recessed in soffit.

Desk and dressing table. Mirror folds flush with top when used as desk; unit lowered when not in use.

Another operational peculiarity is the passengers themselves. While people living in one locality may have similar ideas of comfort, it is mere repetition to state that most nationalities have their own ideas on the subject. A ship must cater to the demands of individuals from all nations. Many countries are not as familiar with comfort cooling as we are, and, frequently, their first reaction to it is not favorable. It is, therefore, necessary from a psychological point of view to administer a candy coated pill by allowing the individual to make his own climate. This, in some extreme cases, may amount to obliterating the theoretical comfort which the system was designed to achieve. It is obvious, therefore, that a good designer must study the trade's climatic characteristics, as well as those the trade serves.

Cost

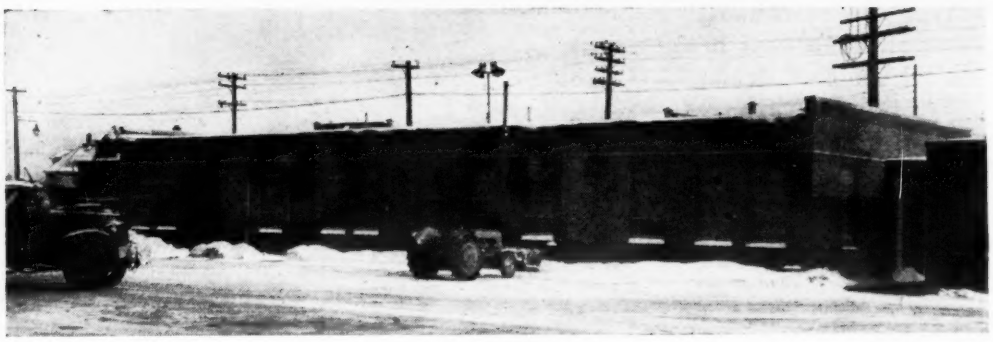
Cost is what you spend to achieve a certain result. The construction of air conditioning systems for ships is more complicated than similar installations on land. This exists because operation aboard ship is more severe, and ships must be designed for extreme conditions. Furthermore, the compactness of ships requires that the air conditioning be more reliable.

Ship air conditioning is too new to be analyzed in detail with respect to cost. With the exception of the refrigeration machinery, cooling coils, controls, and chilled water piping, the rest of the systems should not cost more than a first-class marine heating and ventilating job. It is important to note that smaller air handling equipment is required, and this tends to offset the added cost of the refrigeration equipment. The marine industry is only too glad to pay the cost—if they get what they are paying for.

Space Limitations

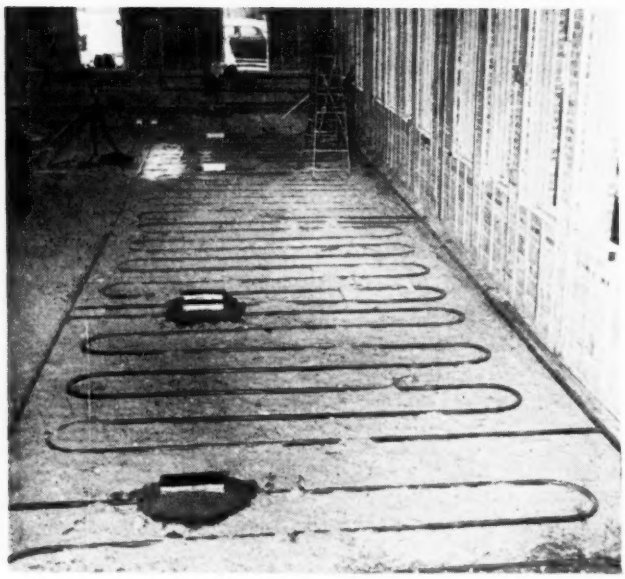
These always have been, and always will be, a subject of major importance to ship ventilating and heating. Naturally, this also applies to complete

(Concluded on page 133)



Personnel building at Detroit plant of Thompson Products, Inc.

Calculations for Radiant Heating an Industrial Building



Welded radiant heating coils in position on layer of sand atop 6 in. crushed stone base. Each of the rooms has its individual coil. Note supplemental wall coils beneath windows of corner rooms.

RADIANT heating is rounding out its first season in the Personnel Building at the Michigan plant of Thompson Products, Inc., Detroit, and reports indicate that the performance of the system has confirmed the judgment of the design engineer, Robert L. Byers, of John Paul Jones, Cary and Millar of Cleveland. The architect was Sterling L. Neale, of Thompson Products' headquarters in Cleveland.

Conceived to house some 10 small offices, and medical department, the 38½ ft x 88 ft one-story structure has its concrete floor laid on the ground. This, plus the need to incorporate a heating system of such design that office partitions could be moved at will, were decisive factors in favor of radiant heating.

After virtually a complete winter in the new structure (it was completed in September, 1944), the occupants report that the building has been very comfortable, that the heat has been noteworthy for its evenness, that the system has responded to outdoor temperature changes, and that cleanliness has characterized its operation. The floor has been consistently at a comfortable temperature.

Construction of the building is as follows:

Walls: 4-in. brick, 8-in. Haydite block, ½-in. insulating lath, furred, and plaster, with a coefficient of 0.17 Btu per hr per sq ft per deg.

Glass: single glazed, double hung, wood sash, with storm windows, with a U-factor of .45.

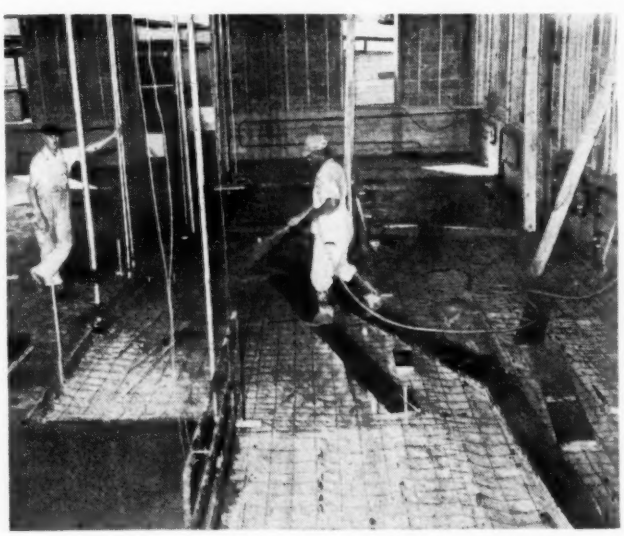
Infiltration: based upon 23.6 cu ft per hr per foot of crack of window, which is 30 Btu per hr loss per foot of crack, at the design conditions of 0-70F.

Roof: 1-in. wood with built-up roofing (4-in. rock wool batts between joists). The ceiling had a U-factor of .066, which equals 4.6 Btu per hr loss at a 70F differential. However, a factor of 8 Btu per hr per sq ft was used because the insulation was mounted between the wood joists.

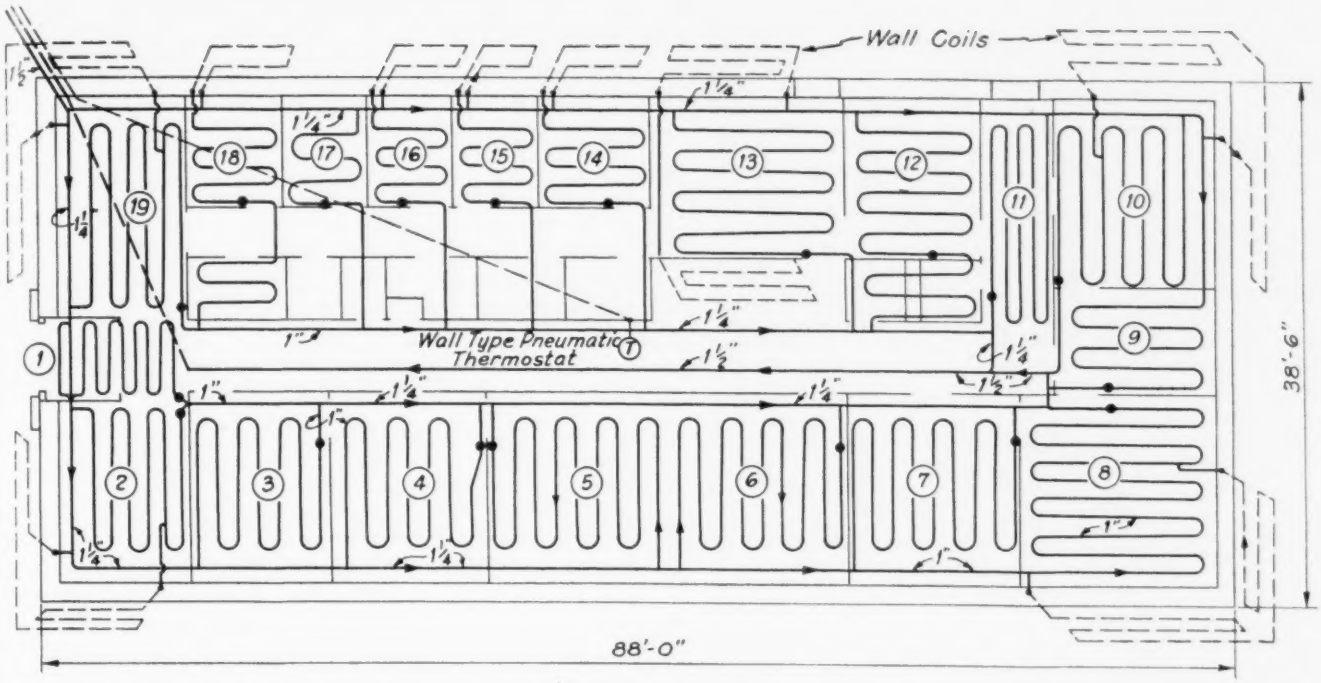
Finish floors: asphalt tile, applied to the concrete with a mastic, or terrazzo.

To provide comfort at 0F outdoors, the design water temperature was set at 120F and the room temperature at 70F, giving a 50F difference between the room and the water.

As sinuous coils of 1-in. pipe were laid in the floor

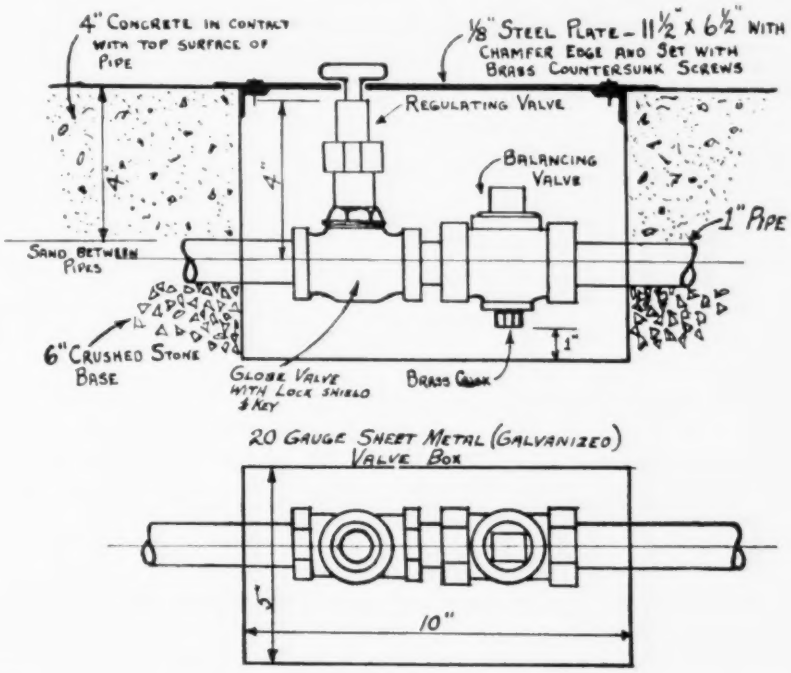


Concrete floor slab partially poured. Top of pipe is in contact with the slab.



Radiant heating coil layout. Wrought iron pipe was used throughout: 1 in. size for coils, 1 1/4 in. and 1 1/2 in. for distributing mains. Figures show location of rooms as follows: (1) Vestibule; (2), (3), (4) Office; (5), (6) Counter Room; (7), (8), (9), (10) Office; (11) Passage; (12) Office; (13) First Aid; (14) Treatment; (15) Examination Room; (16) Doctor; (17) Examination Room; (18) Nurse's Room; (19) Office.

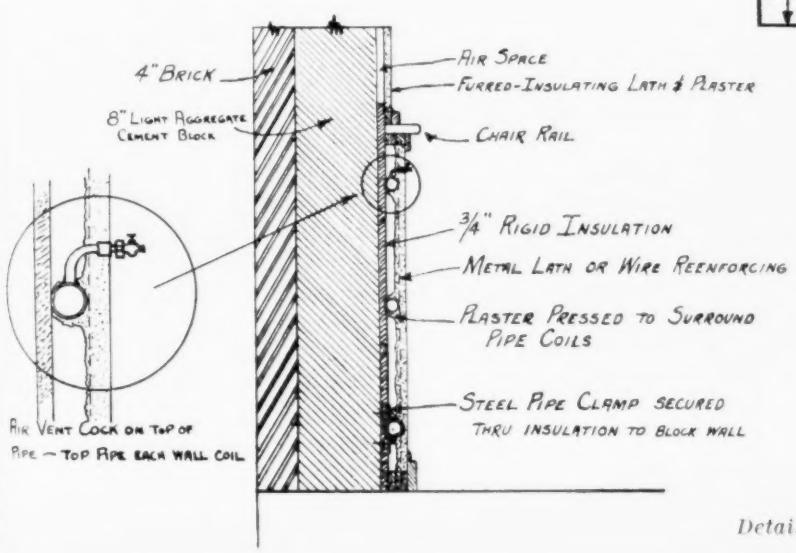
Right, detail of valve box


4" Concrete in contact with top surface of pipe
1/8" Steel Plate – 11 1/2" x 6 1/2" with chamfer edge and set with brass countersunk screws
Regulating Valve
Balancing Valve
1" Pipe
Sand between pipes
6" Crushed Stone Base
Globe Valve with Lock Shield & Key
Brass Cock
20 Gauge Sheet Metal (Galvanized) Valve Box
10"

approximately 18 inches on centers, this indicated a total output, in all directions, of 60 Btu per hr per foot of pipe and an output to the room of 31 Btu per hr per sq ft of floor.

The radiant heating floor coils were laid on a layer of sand atop a 6-in. crushed stone base. After the welding of the coils was completed, the system was tested under 125-pounds hydrostatic pressure for 24 hours, after which a 4-in. concrete slab was poured, the concrete being in direct contact with the pipe.

Supplemental wall coils were installed beneath the windows in the four corner rooms and a few of the other small rooms. These also were fabricated of 1-in. pipe on 12-in. centers, which provided a total output, in all directions, of 60 Btu per hr per foot of pipe, and an output of 52 Btu per hr per sq ft of wall.


4" Brick
8" Light Aggregate Cement Block
Air Space
Furred-Insulating Lath & Plaster
Chair Rail
3/4" Rigid Insulation
Metal Lath or Wire Reenforcing
Plaster Pressed to Surround Pipe Coils
Steel Pipe Clamp secured thru insulation to block wall
Air Vent Cock on top of Pipe – Top Pipe each wall coil

Detail of installation of pipe coils in walls

Approximately 107 ft of 1½-in. pipe and 245 ft of 1¼-in. pipe were used for the distributing mains, in addition to the 2200 ft of 1-in. pipe used for the coils. The heating piping was wrought iron throughout. The Bassler-Carter Co., Detroit, the heating contractor, fabricated most of the coils in its shop.

The amount of pipe needed for the

First aid room in finished building.

coils was individually figured for each room. In one typical non-corner room, the following method was used.

Calculations for Pipe Length

Heat loss = 4961 Btu per hr; Floor area = 147 sq ft; Unit output = $\frac{4961}{147}$ = 33.7 Btu per hr per sq ft of floor.

Assuming a downward heat flow equal to 30% of the upward requirement, the total input then becomes 4961 × 1.3, or 6450 Btu per hr. Pipe output, 1¼-in. pipe = 22.5 lin. ft × 76 Btu per hr = 1710 Btu per hr. Pipe output of 1-in. pipe = 80.5 lin. ft × 60 Btu per hr = 4830 Btu per hr, a total of 6540 Btu per hr.

Calculating the system for one of the corner rooms with wall coils was carried out as follows:

Heat loss	= 9384 Btu per hr
Deduct wall loss where wall coils occur, (28.5 ft × 2.5 ft × 12 Btu per hr)	= 855 Btu per hr
	8529 Btu per hr

Assuming a downward or outward heat flow (from floor to ground or wall to outside air) equal to 30% of the conductance and infiltration losses, the output is 8529 × 1.3, or approximately 11,000 Btu per hr.

Floor coils placed on 18-in. centers accounted for 142 lin. ft of 1-in. pipe, or 8520 Btu per hr. (142 × 60 = 8520 Btu per hr.)

The difference between 11,000 Btu per hr and 8520 Btu per hr, or 2480 Btu per hr, was supplied by the wall coil and was calculated as follows: 2480/60 = 41 1/3 ft of 1 inch pipe.

Because of the circuit desired, 75 ft of pipe was actually used in the wall coil. However, since this coil is at the end of the main and therefore receives the coolest water, it was felt that this overage would be advantageous.

After the total heat input was obtained, the quantity of water to be circulated was based on a 10F drop, so that the hot water heater in which the plant steam-to-water heat transfer is effected was sized to heat the water from 115F to 125F. Subsequently, on a day when the outdoor temperature was 3F above zero, a test showed the water leaving the heater at 122F and returning at 112F.

Piping was laid out in a reverse return circuit to minimize balancing. Each room has an individual pipe coil with a plug valve for permanent adjustment and a hand valve with a loose T-handle. Both valves are set in a sheet metal box in the floor and are covered with a flush plate.

Temperature control was designed as a constant-circulating water pump with water temperature controlled by a room modulating thermostat, located in the corridor. There is also an immersion thermostat located in the water discharge to limit the water temperature to 125F.

Protection from Fire Hazards of Flammable Solvents

Every year flammable solvents, such as gasoline, naphtha, benzene, and acetone, cause fires and explosions that kill or injure hundreds of persons and destroy property worth millions of dollars in American business establishments. To ensure safety therefore, adequate protection from these hazards must be provided wherever flammable solvents are employed.

Even when used in small quantities, flammable solvents require careful handling. They should be kept in approved safety cans and applied where there is no danger of ignition from flames, mechanical or electric sparks, or high temperatures due to fire or friction. Smoking in the area of application should be prohibited.

Where large quantities of flammable solvents are used, further protective measures are necessary.

To prevent disastrous explosions, the concentration of solvent vapor in the atmosphere must be kept below the lower explosive limit by using equipment that minimizes the escape of vapor into the air and by supplying a sufficient amount of fresh air by means of natural or mechanical ventilation. In practice, the vapor content of the workroom air should be kept below the maximum allowable concentration for continuous exposure, which is basic protection from both toxicity and explosion.

But good general ventilation does not eliminate the localized fire hazards created by volatile flammable solvents. Special precautions must be taken to prevent the ignition of spills, creeping vapors, which may travel 100 feet or more from the point of origin, vapors collected in low places, such as pits or basements, and the explosive vapor-air mixtures that remain in containers emptied of solvents.

Atmospheric Pollution Due to Smoke

ARTHUR C. STERN

THE original movement for the diminution of atmospheric pollution was known as smoke abatement. As a result, "smoke" has become a catchword covering all types of air pollution. However, much of the damage attributed to smoke is not caused by smoke at all but rather by the acid and odorous gases, the cinders, and the fly ash accompanying it. Smoke, itself, consists of minute solid particles of carbon and hydro-carbons resulting from the destructive distillation and incomplete combustion of the complex volatile hydrocarbons in fuel. The case against smoke is its well-known dirtying action, its well-proven adverse influence upon atmospheric visibility, its presumed adverse effect upon health, and its indication of avoidable fuel waste.

Smog

Much of the early smoke abatement work was in England, where smoke from a myriad of coal burning open fireplaces is responsible for the so-called smog of London and other British cities. Smog, a composite word made up of the words smoke and fog, means a mirky fog, presumably stabilized by smoke particles. It is difficult to prove that the smoke causes the fog because even smoke-free air has ample condensation nuclei to form a fog. The polluent best able to stabilize a fog is SO_2 which in a mist can oxidize to SO_3. A droplet of sulfuric acid, the form in which SO_3 would exist in a mist, will be stable at a lower relative humidity than a droplet of water. Therefore, once a fog is formed in an atmosphere containing SO_2, it will tend to be a more persistent fog than one in an unpolluted atmosphere. It will also be a more objectionable one because of its corrosive and irritant character. Smoke will endow such a fog with an increased opacity and ability to dirty things. The sun breaking through can quickly evaporate the haze of unpolluted areas. However, dissipation of a smog is not so rapid, because of both the stabilizing influence of SO_2 and the greater opacity to the sun's rays.

In a normal atmosphere, air temperature decreases as we rise above the earth's surface. When this occurs, vertical convection currents and eddies persist which help dissipate both pollution and fog. Occasionally, however, temperatures in the lower air are inverted, i.e. they increase as we rise above the ground. This inhibits vertical air motion and causes a ceiling to exist over the area. Pollution will accumulate under this ceiling, and fogs will tend to persist. Any factor influencing the maintenance of a temperature inversion will therefore also increase fog duration.

We have good reason to believe that the Btu in the fuel burned in a big city, almost all of which is eventually dissipated as heat through building walls or from flue gases, may by maintaining upper air temperature help maintain an inversion ceiling.

Radiation fogs result when heat radiation from warm air to the cooler earth drops the air temperature below the dew point. Since such radiation is accelerated by radiation from solid particles in the air, it is presumed that radiation fog frequency increases with increased smoke and dust concentration in the air. It will be noted in this connection that some cities are, by geography, more prone to fog formation and maintenance than others. As an example, cities located in cool valleys into which warm damp air may occasionally flow would tend to have frequent fogs.

Adverse Effects of Smoke

Little need be said of the dirtying action of either smoke or smog. We are too well aware of it. Laundry, house furnishings and buildings would not have to be repeatedly cleaned of soot. The achievement of this end is the most potent argument yet advanced for smoke abatement. The dirtying action of smoke on vegetation coats the leaves and by blocking pores denies the plant its quota of sunlight and air. Only the hardiest plants can be grown in our smokier cities. That a smokeless city can also be a greener one is another strong argument for smoke abatement.

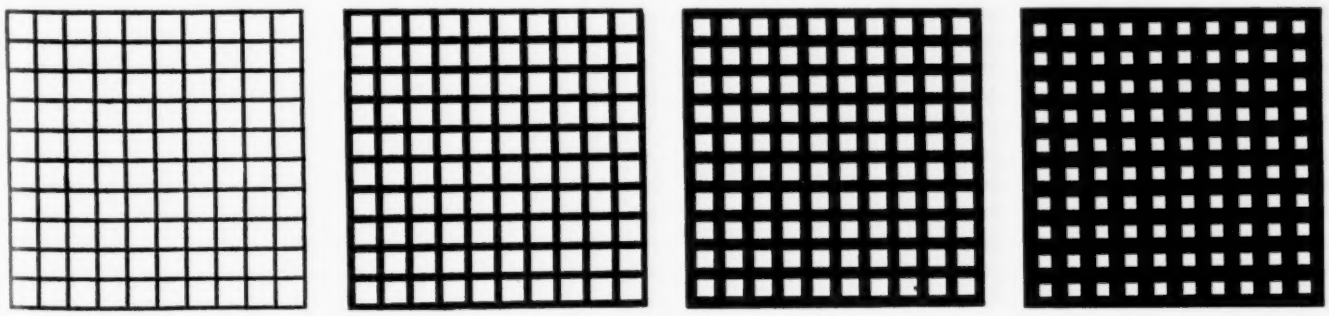


Fig 1. Chart (about 3 times size of the reproduction) is held 50 ft from observer until squares appear as even shades of gray, and the tone value is compared with the smoke values. A is equivalent to 20% black; B, 40%; C, 60%; and D, 80%.

Smoke decreases atmospheric visibility not only by making a fog more opaque but also by decreasing light transmission on non-foggy days. This causes both a decrease in horizontal visibility and a decrease in transmission to the earth of the components of sunlight. Asborption of both visible light and ultra-violet by the smoke cloud is determined by comparing the light energy received at ground level in the urban area in question with that received at a near-by smoke-free rural area. Special photocells are the favored means of measurement, although photo-chemical and spectrographic means are sometimes used instead.

Studies by the U. S. Public Health Service[1] in New York City recorded a 21.5% average annual loss of daylight due to absorption by the smoke cloud over the city. On occasional days this loss exceeded 50%. The average loss for clear days was 16.6%; for cloudy days 34.6%. A greater percentage light loss was observed on still days than on windy ones. This is in accord with everyday experience that wind clears a smoky atmosphere.

Loss of light means a monetary loss to each of us due to the need for additional artificial illumination, to slow-downs and tie-ups of aerial, marine and ground transportation, and to inhibition of the growth of urban vegetation.

In assessing the effect upon our health of a smoky atmosphere, the diminution of the amount of ultra-violet reaching the earth plays a very important part. It is unfortunate that smoke is at its worst in midwinter when the quantity of ultra-violet transmitted to the earth is least and our need for it greatest. A deficit in our normal quota of ultra-violet is associated with rickets in children and a loss of body "tone" in adults. The extent to which this deficit contributes to disease because of its lowered bactericidal power is wholly problematical.

Some of the smoke particles inhaled over a lifetime are held in the lungs resulting in the characteristic dark colored lungs of city dwellers. Several investigators have correlated respiratory disease incidence and severity, particularly the latter, with the smokiness of the atmosphere. Such studies have led medical men to the conclusion stated in the report of the Committee on Public Health Relations of the New York Academy of Medicine[2], that:

"Inhalation of carbon particles and irritating fumes lower the resistance of the nasal mucous membrane, rendering it susceptible to acute and chronic infections which may involve the ear. Enlargement of the tonsils, redness and congestion of the pharynx and larynx have also been ascribed to atmospheric pollution. Smoke likewise irritates the membranes of the entire respiratory tract, predisposing to pneumonia, and emphysema. Smoke diminishes the potential reserve, working capacity, and well-being of the individual, and increases fatigue and irritability, whereas sunshine exerts an exuberant influence on the feelings."

Density of Smoke Discharges

There are three general types of smoke measurement methods. First, there are those which determine the smoke density of the flue gases emitted from a single stack. Second, there are measures of total smoke in the air of an area. Last, there are indirect measurements of effects caused by smoke in the air.

The density of smoke from a stack is usually measured visually by the use of a Ringlemann chart (Fig. 1) or a Roberts chart. Smoke density is reported as No. 1, No. 2, etc., depending upon which section of the chart compares closest with the smoke as it emerges from the stack. Smoke inspectors, whose job it is to make many smoke density observations each day, do not customarily set up a Ringlemann chart in their field of vision before each observation. They rely instead on their memory of the scale, thinking of the smoke they see in terms of "percent black" (for each number on the Ringlemann scale represents an increment of 20% black between the limits of No. 0-0% black and No. 5-100% black). Since many smoky discharges are not black even at maximum density, inspectors also measure smoke density in terms of what they can see through the smoke, i.e., No. 2 smoke being that which can just be seen through; No. 3 smoke that which just obscures objects behind it.

In an instrument called the Umbroscope the observer views the smoke through a telescope-like tube and compares the color in one half his field of vision with a set of variable density clouded glasses in the other half of that field. The same principle has also been applied to a smoke density camera, so that a variable density strip appears on the one side of each photograph. A motion picture camera, built along these lines, and, in addition, equipped with means to take an exposure every 15 seconds, has been tried for obtaining a record of smoke from a stack over a period of several hours. The main drawback in its use was inability to vary exposure with varying illumination. However, electronic means now available to maintain correct exposure at all times can overcome this difficulty.

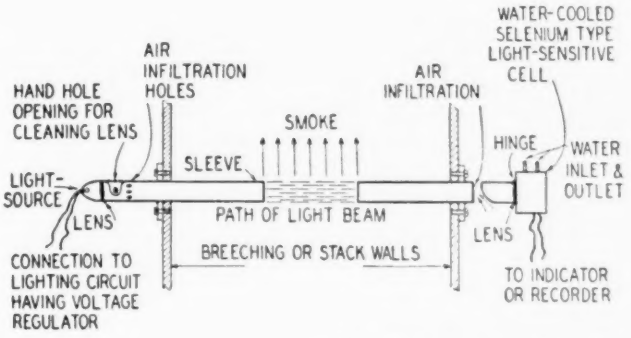
Instead of measuring the density of smoke after it leaves the stack, it is possible to determine its density in the stack before discharge. This method is used when a plant desires to control or record its own smoke output. Most smoke meters depend upon diminution by the smoke of a beam of light projected across the stack through the smoke. In the simpler smoke meters, mirrors are so disposed that the beam of light which has traversed the stack is reflected to an eye-level location in the boiler room so that a visual estimate of smoke density may be made at that point. In the more elaborate meters (Fig. 2) the diminution of light is measured by a photocell at the stack and is indicated by an electric meter in the boiler room. In a variation of

[1]Ives, J. E., Studies in Illumination—III: A Study of the Loss of Light Due to Smoke on Manhattan Island, New York City. Public Health Bulletin No. 197. U. S. Public Health Service, June 1930.

[2]Effect of Air Pollution on Health, Bulletin of the New York Academy of Medicine, second series, Vol. 8, No. 9, Sept. 1931.

this latter method, a sample of the smoke is withdrawn from the stack and passed through an auxiliary measuring tube in which the diminution of light is measured by a thermopile.

Either of these groups of devices will be reliable only so long as their optical systems are kept polished, which usually means cleaning at least daily. Otherwise soot or dust on the lenses, windows or mirrors in the system will cause a diminution of light equivalent to smoke in the light path. Constancy of performance of light source and photocell are, of course, also essential for satisfactory results.



Courtesy, Mechanical Engineering.

Fig. 2. Photo-electric smoke density meter.

Whenever a photocell type meter is installed on a stack, the question invariably arises as to the correlation of its readings with those of a smoke inspector using the Ringlemann scale to observe the effluent stream. The observer is influenced by color, reflection from the smoke and brilliance of background, all of which do not influence the photocell. On the other hand, the cell is greatly influenced by the length of the light path through the smoke, that is the diameter of the stack, a factor for which the trained smoke observer can make only partial allowance.

The use of sleeves to control the length of light path are of most value, not when they are set at some arbitrary distance apart based on theory, but when they are experimentally adjusted to the opening which results in best correlation with visual Ringlemann chart readings of No. 2 or No. 3 smoke. This is so because most smoke ordinances prohibit the emission of smoke in excess of No. 2 or No. 3 either unconditionally or for more than a specified length of time. If the smoke meter does not tell the plant operator when he is in violation of the local ordinance, it is not serving its function.

Area Smoke Density

In his day to day work, the community smoke abatement officer measures the smoke pollution of an area by noting the number of stacks smoking and recording the number of minutes, during an observation of perhaps fifteen minutes, that each stack emits smoke of each Ringlemann chart density. His observations are usually random in the sense that the area smoke density is calculated from all routine readings on stacks during the course of a month's or a year's work. However, when a special survey is wanted to determine the smoke density of an area without full readings on each stack, a predetermined routine of using several building roofs as observatories may be set up instead. Where local ordinances stipulate maximum permissible smoke density, this type of measure shows the extent of compliance with the ordinance and the magnitude of the abatement job to be done.

Suspended Impurity

Determination of suspended atmospheric impurity per unit volume of air is a procedure any competent chemist can perform. All that is required is a means for aspirating air through a filter and metering the aspirated air. If only a weight measurement of collected suspended material is desired, the less hygroscopic filter media, such as alundum, are advantageous because of the ease with which they are dried to constant weight before and after sampling. However, aspiration through a filter medium may also be used as a means for measuring the dirtying effect of the atmosphere, in which case white filter paper is usually the medium. Therefore when the same sample serves the dual purpose of a weight measurement and a blackness measurement, laboratory filter paper is customarily used, even though its use for weight measurement requires long drying and repeated weighing to a constant weight. Weight measurement of suspended impurity does not yield too satisfactory an index of the nuisance caused by this impurity. This is so because the nuisance is mainly due to the blackness produced, and the blackness does not always bear a direct relationship to the weight of suspended impurity.

Thus, if in the summer, the atmosphere of a city is polluted by considerable power plant fly ash and only little soot from smoke, the quantity of suspended impurity will be high and its dirtying capacity low. The quantity of soot may markedly increase in the winter, increasing the dirtying capacity of the atmosphere with but little change in the weight of total suspended impurity. Because of this no reliance can be placed on any constant factor for the conversion of filter paper blackness, caused by passing a known quantity of air through a definite area of paper, to weight of suspended impurity per unit volume of air. A factor of this type, even when supplied with an instrument, as it is in the case of the Owens automatic air filter, had therefore best not be used. Blackness records are by themselves such good indications of the nuisance caused by air pollution that there is really no necessity for converting them into something else.

Owens Automatic Air Filter

The Owens automatic air filter is a device for taking 96 discoloration samples, one every 15 minutes, on a single sheet of filter paper. It has been extensively used abroad for a number of years and was used here in the study of air pollution of American cities conducted by the U. S. Public Health Service from 1931 to 1933. The blackness of

Owens filter samples are determined by visual comparison with a standard set of shades of increasing blackness, prepared by repeatedly coating white paper with a weak India ink solution. Thus the uncoated white sheet has a shade number of 0 and the square which was painted with 20 coatings, and is almost black, has a shade number of 20. Intermediate shades of grey are numbered 1, 2, 3, 4, 6, 8, 10, 12 and 15 according to the number of coats given.

Investigators[3] found the average shade to be 1.3. In common with European experience, Ives found both a seasonal and diurnal variation in atmospheric blackening ability as well as a correlation with industrial activity and with wind. Ives' shade numbers show consistent minima at about 3:30 a.m. and noon, and maxima at 7:30 a.m. and 8 p.m., the morning peak having a shade number about twice that of the noon low. European data tend to show a more marked early morning minimum and late morning peak and a less marked noon minimum and afternoon peak. Shade numbers on Sundays are consistently about 0.3 of a shade lower than at similar hours on weekdays. In general, both higher wind velocity and increasing wind velocity are associated with lower shade numbers as are winds from directions with no pollution sources, as for instance, a large body of water such as one of the Great Lakes.

It is British practice to separately report shade numbers for hazy days (z days), in which a shade number of 4 is reached for any 15-minute interval during the day, and ordinary days. The result of this separation is that under pre-war conditions in London and Dublin about 80% of winter weekdays were ordinary days, while 20% were z days. The morning peak is much more pronounced on z days than on ordinary days.

Smoke Producing Tendency of Fuels

Engineers realize that with proper design and operation any fuel may be burned smokelessly. However, with some fuels slight deviations from optimum design and operation will cause smoke emission, whereas with other fuels very little care need be exercised to obtain smokeless combustion. There is, therefore, a marked difference between fuels in their inherent tendency to produce smoke.

Engineers have known for years that, in the case of coal, the smoke producing tendency is related to the percent of volatile combustible matter in the fuel. Although this concept is reliable in comparing the smoke producing tendency of bituminous coals, it can lead to erroneous conclusions when applied to other coal types. In the case of lignites, subbituminous and semi-anthracite coals, volatile combustible matter offers no reliable index of potential smoke production. The use of the tar yield in the Fisher retort (low temperature carbonization) test has been proposed as an index of smoke producing tendency of all ranks of coal. In this test, the coal sample is heated to 932F in a thick-walled retort.

Smoke producing tendency of specific coals may, of course, always be compared by actual boiler plant trials. It is, however, desirable to be able to conduct smoke tendency tests on smaller samples. A small stoker pilot plant with a smoke recorder built into the stack has been used for this purpose, as has a laboratory set-up in which only a few grams of coal sample are required. In this latter test[4], the sample is heated in a muffle furnace to 600° C using an air supply of 4 cubic feet per minute. The smoke produced is measured by passing through a photo-electric light absorption tube which works on the same principle as the smoke meters previously described.

In the case of liquid and gaseous fuels, use of proper fuel-air ratio and intimate mixture of fuel and air are more important than fuel type in obtaining smokeless combustion. This holds for internal combustion engines as well as furnaces. One need merely reflect that the Navy has long used incomplete combustion of fuel oil as a means for making a smoke screen to appreciate the importance of air-fuel ratio.

[3]Ives, J. E., et al. Atmospheric Pollution of American Cities for the Years 1931 to 1933. Public Health Bulletin No. 224, U. S. Public Health Service, March 1936.

[4]Piersol, R. J., Smoke Index. Ill. Geol. Survey, Report of Investigation No. 41, 1936.

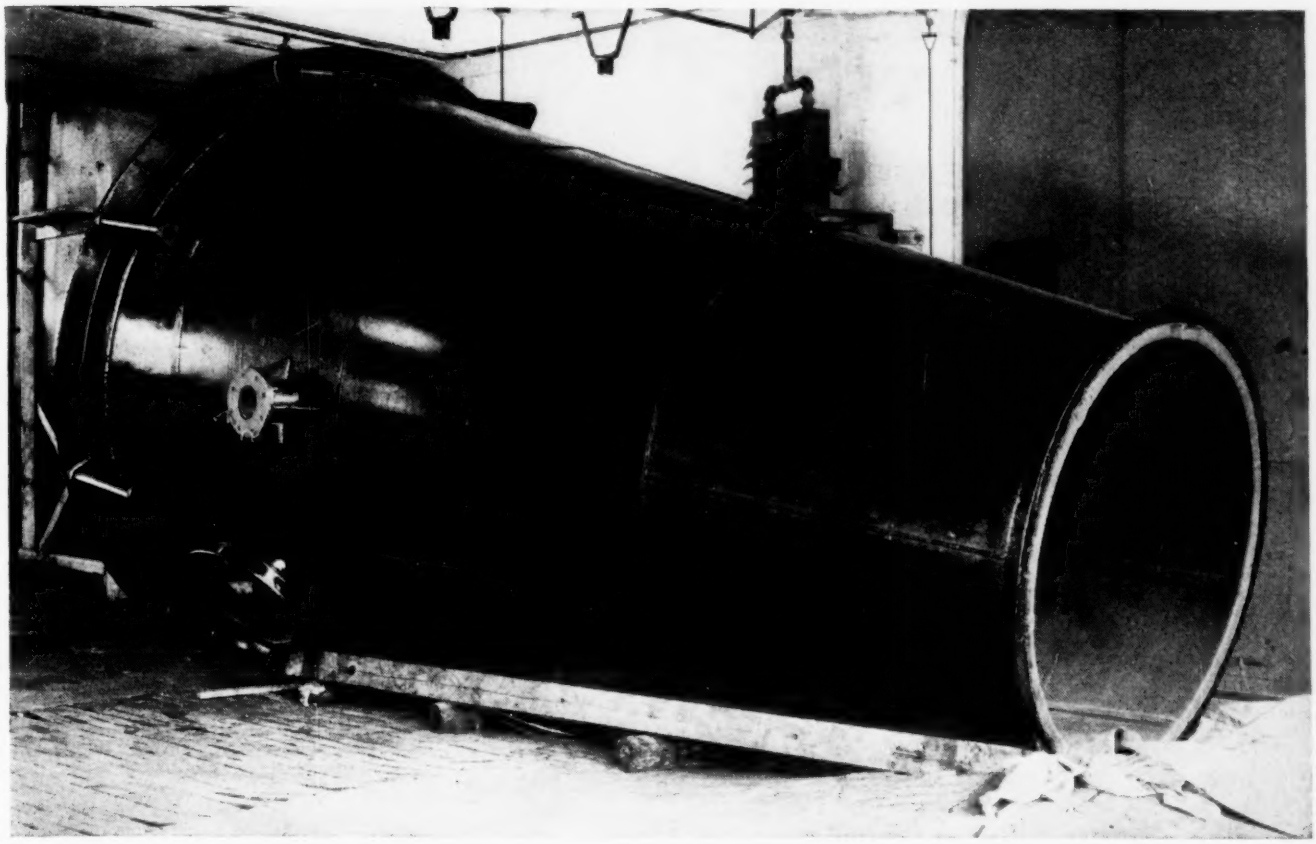
Manufactured Fog Extinguishes Ship Fires

New methods of combating fire aboard ships have been developed by the United States Coast Guard as a result of experience obtained at the disastrous Coconut Grove fire in Boston three years ago. Heat recording instruments are wired to electronic temperature indicators, simplifying methods of locating the fire and of fighting it.

In a test, bunker oil was pumped into the engine room of a discarded Liberty ship and ignited, forming a blazing pool about 4½ inches deep over the entire engine room deck. Within a few minutes the burning oil was controlled by choking off the fire's oxygen supply and applying a low velocity water fog.

"Experimentation shows," says Commander Lloyd Layman, director of Coast Guard Fire Fighting Training, "that every opening feeds air into the burning space. Therefore we covered ventilators and skylights, shutting off the air supply, and the fire died from lack of oxygen. But the heat was so terrific that even after this treatment the fire would start up again with re-ignition of vapors if air gained entry. There is where the low velocity fog comes in.

"A new theory in fire fighting, the water fog is sprayed as a mist throughout the fire area to cool down the hot steel. The small water droplets absorb the heat and thus reduce temperatures."



Synthetic rubber on the inside of this flue protects metal from corrosion by chemical fumes.

Rubber-lined Ducts and Cylinders

INDUSTRY often makes heavy duty demands on the materials it uses. Because of fumes and liquids which are corrosive and abrasive on unprotected metals, some thought must be given to linings resistant to corrosion and abrasion.

In presenting data on synthetic rubber lined ducts and cylinders, attention is called to the fact that because of its cost and engineering tolerances required in metal fabrication, it is not a material for the average run of duct work. However, it has proven itself for industrial work where some severe corrosion problem makes justifiable effective corrective measures even though costs are higher than the customary light gauge work.

Metal work must be made to exact specifications and should fit when assembled in the field. Change in dimensions after fabrication is difficult. With this material, some thought must be given to the joints so that they fall in desirable locations.

Synthetic rubber linings are used, and depending upon the use to which the duct will be put, neoprene, Buna S or Buna N is available. While in general it can be said that natural rubber is superior to synthetic rubbers in many performance characteristics, synthetic rubbers are superior to natural rubber in resistance to many influences that cause deterioration. Synthetics have as good aging qualities at natural rubber. Physical and chemical properties of each are summarized in Table 1.

For special services and particularly if the lining comes in contact with oils, the use of neoprene is indicated. Buna S will stand up under most chemicals (for detailed information see Table 2), but will not take strong nitric acid or other oxidizing agents nor

Sections of rubber-lined flue built to conduct silicon fluoride at temperatures up to 220F. The flue is designed to be installed horizontally and is to connect with rubber-lined cleaning and absorption towers.

TABLE 1.—COMPARATIVE PROPERTIES OF NATIONAL AND SYNTHETIC RUBBERS

Physical Properties	Natural Rubber	Buna S Type	Buna N Types	Neoprene Types	Butyl Type	Thiokol Polysulfide Types
Extensibility	Excellent	Good	Good	Excellent	Excellent	Good
Resilience	Excellent	Good	Fair-Good	Very Good	Low	Good
Tensile	Excellent	Fair-Good	Good	Very Good	Good	Fair
Electrical Properties	Excellent	Excellent	Fair	Fair	Excellent	Fair
Impermeability to Gases	Good	Good	Good	Very Good	Excellent	Excellent
Impermeability to Water	Good-Very Good	Fair-Good	Fair-Good	Fair-Good	Very Good	Very Good
Resistance to:						
Plastic Flow	Very Good	Good	Good	Good	Fair-Good	Low
Abrasion	Very Good	Good-Very Good	Good-Very Good	Very Good	Fair	Low
Tear	Very Good	Fair-Good	Fair-Good	Good	Fair-Very Good	Fair-Good
Heat	Good	Fair-Very Good	Fair-Very Good	Very Good	Fair	Low
Cold	Very Good	Very Good	Fair-Good	Fair-Very Good	Good	Fair-Good
Chemical Properties						
Resistance to:						
Air	Fair	Good	Good	Excellent	Excellent	Excellent
Ozone	Inadequate	Inadequate	Fair	Excellent	Excellent	Excellent
Light	Fair	Fair	Low	Excellent	Excellent	Excellent
Petroleum	Low	Low	Excellent	Good	Low	Excellent
Aromatic Oils	Inadequate	Inadequate	Fair	Low	Inadequate	Excellent

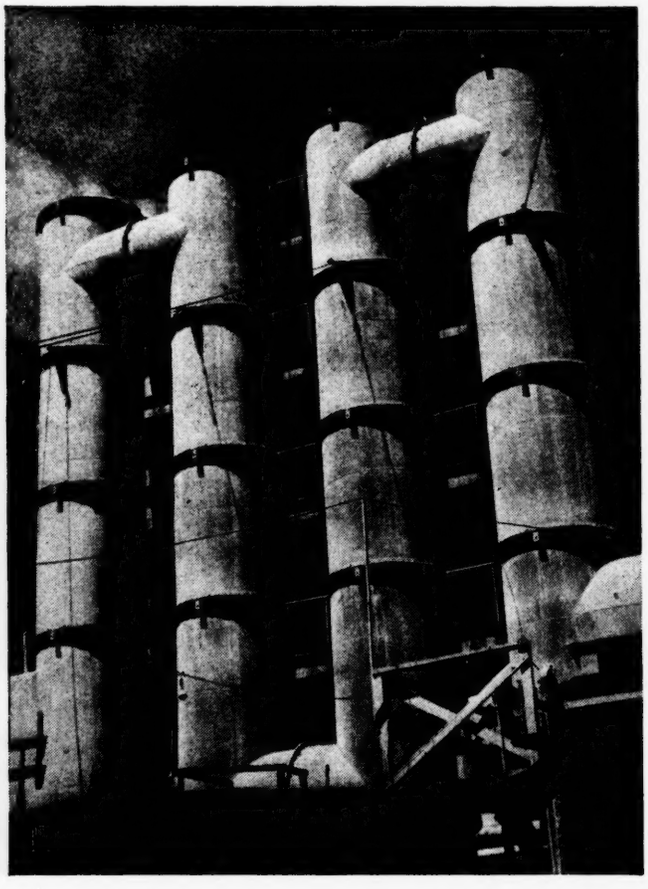
Note: This chart covers only generalized types of synthetic rubber. Individual properties may be developed by special compounding, as suggested by the ranges shown in the table.

is it suitable for temperatures any higher than 180F.

Metal for fabrication must be heavier than the gauge customary for sheet metal work to permit installation of the lining and when the line is installed, the duct walls must be firm enough to resist any breathing action or movement. The inside surface of the duct is sand-blasted and cemented and the synthetic is applied in sheet form like wallpaper. Generally the sheets are ⅛ in. thick but for more severe service, 3/16 in. thick sheets may be used. By compounding and vulcanizing, any desired degree of stiffness can be secured. Semi-hard rubber is suitable for 85% of the jobs.

TABLE 2.—CHEMICALS AND CHEMICAL SOLUTIONS WITH WHICH BUNA-S PERMOBOND TANK LININGS ARE SUCCESSFULLY USED

Acetic acid	Magnesium chloride
Aluminum chloride	Phosphoric acid
Ammonium chloride	Sodium chloride
Ammonium sulfate	Sodium hydroxide
Ferric chloride	Sulfuric acid
Formaldehyde	Lead
Hydrochloric acid	Silver
Hydrofluoric acid	Nickel
Hydrofluosilicic acid	



These towers, protected by Permobond, a lining developed by the United States Rubber Company, resist the effects of hydrofluosilicic acid. They replaced wooden towers, which deteriorated quickly, and they resulted in increased efficiency and reduced costs.

Coefficients of expansion differ for metal and the synthetics, about in the ratio of 7 to 1. However, the stretch in the rubber and the method of installation compensates for the differential.

As corrosive fumes must be exhausted by fans, the fan blades and housing are also protected by synthetic rubber coatings. When the fan rotates, the rubber is under tension due to the action of centrifugal force, and while in this strained condition, it can be damaged by abrasive material and by entrained water droplets striking the blades. Rubber under tension is easily cut.

As a precaution, fans with rubber coated blades in industrial work must be placed far enough away from gas scrubbers to avoid water being drawn into the fan. Periphery fan speed should not exceed 10,000 fpm.

Data for this article supplied through the courtesy of United States Rubber Company.

A Summary of Design Data for Exhaust Systems

ALLEN D. BRANDT

Senior Sanitary Engineer, U. S. Public Health Service, Safety and Security Division, Office of the Chief of Ordnance, Chicago

HEATING AND VENTILATING'S REFERENCE SECTION

SINCE the design of adequate and efficient local exhaust systems is something of a specialty, a much too large percentage of those installed in the past and even being installed today is unsatisfactory. Even though all phases of the design problem cannot be covered here, detailed, specific, and simplified data and charts are presented on the calculations involved in the design of satisfactory hoods and ductwork. A design problem is calculated.

The first step in the design of any local exhaust system is the design of the hood or hoods.

DESIGNING THE EXHAUST HOODS

Hood design involves the following distinct steps:

1. Study of the process or operation.
2. Selection of minimum control velocity.
3. Study of equipment and structure surrounding the operation.
4. Selection of the best type of hood.
5. Determination of the volume of air which must be exhausted.
6. Development of hood shape and size.

1—Study of the process or operation. Most operations or processes vary sufficiently one from the other so that each requires individual consideration if a reasonably satisfactory control system is to be obtained. Some operations disperse dusts or mists at a high velocity in a more or less definite direction—others in all directions, and some release the material without any significant initial velocity. At some operations there is considerable air disturbance caused by nearby open doors or windows, or by rapidly moving machinery; at others there is no significant disturbance. At some operations the specific gravity of the contaminated air is sufficiently different from the room air to require consideration; in others the temperature difference is of primary importance.

2—Selection of minimum control velocity. Here experience is a great asset; however, a satisfactory minimum control velocity can be selected by using Table 1 as a guide. The minimum control velocity is the air velocity which must be created by the local exhaust hood at the source (or over the area) of contaminant release to capture a sufficiently large percentage of the contaminant to prevent the creation of a health hazard. A health hazard will exist if the concentration of the contaminant in the air breathed by the nearby workers exceeds the maximum allowable concentration.

The use of Table 1 as a guide by the inexperienced engineer may frequently result in inadequate control unless the designer bears firmly in mind the fact that most control velocities are very low and can be nullified by drafts or nearby moving machinery. For example, the average person walks at the rate of 350 fpm. Consequently, a worker or piece of equipment, such as a crane or motor operated lift-truck, may create an air movement in excess of 100 fpm at nearby operations. On the other hand, an over-designed system and unnecessary heat loss will result if the minimum control velocity is selected to meet all contingencies. A certain amount of atmospheric contamination can be tolerated by the average worker without any demonstrable ill effects. Therefore, it is permissible to allow some contaminant to escape, and in those instances where the air flow pattern created by the hood is upset infrequently for momentary periods, no harm will result as a rule. Only if the interference is frequent or continuous and cannot be eliminated by baffles or partitions, is it necessary to select a minimum control velocity which will overcome the interference.

3—Study of equipment and structure surrounding the operation. This step is a prerequisite to accomplishing steps 4 and 6. It is necessary that the engineer have data regarding the location or area of the contam-

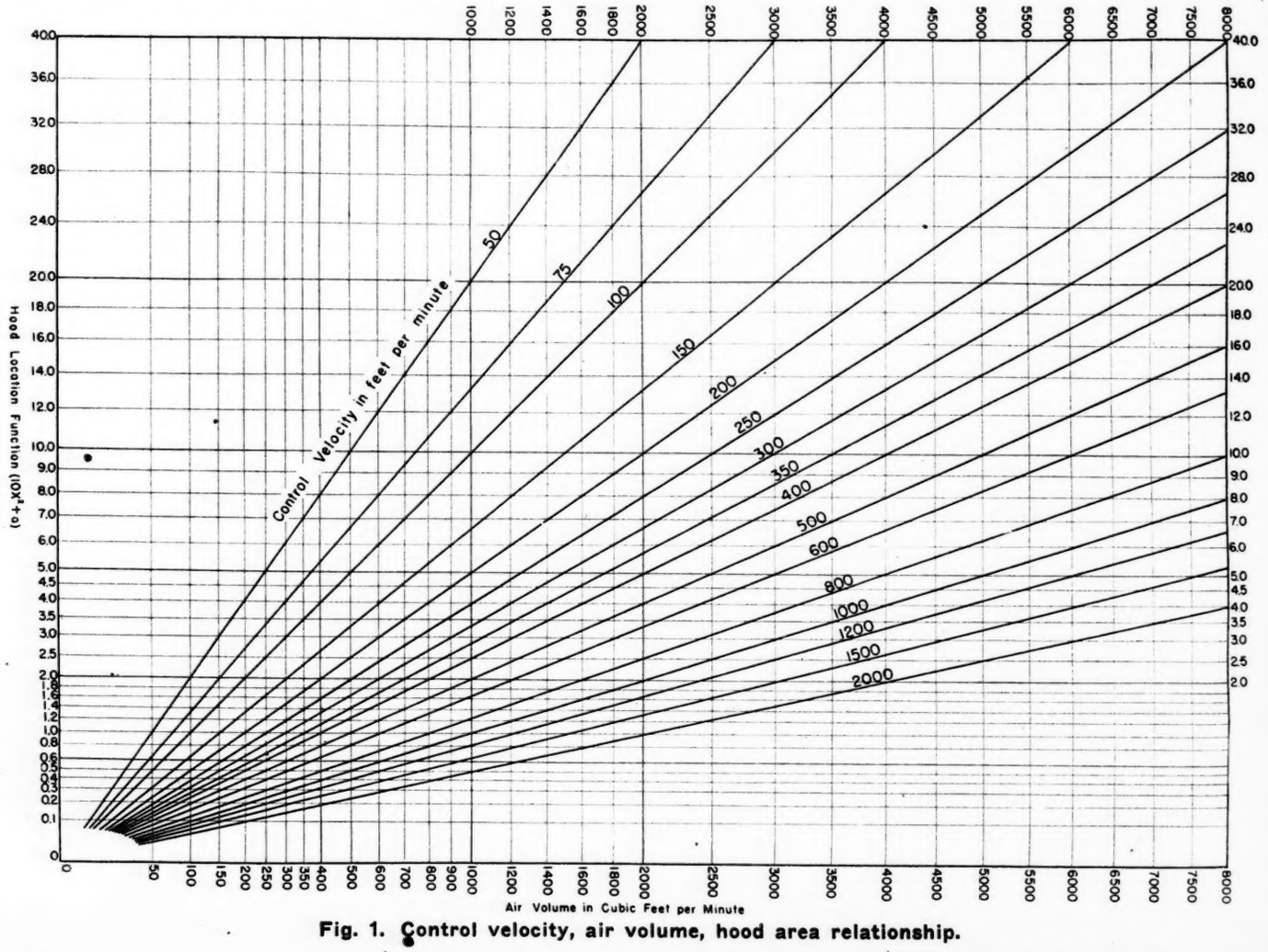


Fig. 1. Control velocity, air volume, hood area relationship.

inant release, the movements of the workers, and the location of other equipment. He may then design a hood which will produce the necessary control velocity at the source (or over the area) of contaminant release with the least amount of air flow and with a minimum of interference with the normal movement of the operators. Also, he must have plans of the building and of the location of other equipment to design the ductwork.

4—Selection of the best type of hood. Steps 1 and 3 provide the information needed to select the type and to determine the hood location. Detailed information on types of hoods will be given later under Air Flow vs Hood Shape. It is necessary that the velocity patterns in front of different types of suction openings be understood clearly if the best hood is to be selected.

In addition to knowing what type of hood to select, it is imperative that (a) the hood be located as near to the source of contamination as possible, (b) the hood be located in the "direction of throw" of the contaminant if possible, (c) it does not interefere with the proper conduct of the operation, (d) due consideration be given to the use of baffles and flanges to prevent disturbance of the air pattern in front of the hood, to stop flying particles or to deflect them into the hood, and (e) due consideration be given to the influence of differences in temperature and specific gravity between the contaminated air in the zone of contaminant release and the general room air.

TABLE 1.—MINIMUM CONTROL VELOCITIES

Minimum Air Velocities Recommended for the Capture of Dusts, Fumes, Smokes, Mists, Gases, and Vapors Released at Various Types of Operations.

Conditions of Generation, Dispersion or Release of Contaminant	Minimum Control Velocity—Ft per Min.	Example of Processes or Operations
Released with no significant velocity into relatively quiet air	100	Evaporation or escape of vapors, gases, or fumes from open vessels; degreasing; pickling; plating.
Released with low initial velocity into moderately quiet air	100-200	Spray paint booths, cabinets, and rooms; intermittent dumping of dry materials into containers; welding.
Released with considerable velocity or into zone of rapid air movement	200-500	Some spray painting in small booths and with high pressure; active barrel or container filling; conveyor loading.
Released with high velocity or into zone of very rapid air movement	500-2000	Grinding; abrasive blasting; surfacing operations on rock.

5—Determination of air volume to be exhausted. The engineer now has a mental picture of the operation, and of the hood shape and location. The next step is to estimate the quantity Q of air which must be exhausted to capture the contaminant. Equations and charts discussed under Air Flow vs Hood Shape, and Table 1 cited previously, enable the designer to determine Q very conveniently.

6—Development of hood shape and size. From information obtained in the first 5 steps in the design, the engineer can develop the approximate hood layout plans with dimensions except for the exact size of the branch duct connection which will be determined later.

AIR FLOW vs. HOOD SHAPE

For this discussion, all hoods may be divided conveniently into four major groups.

1. Enclosing hoods
2. Rectangular or round hoods
3. Slot hoods
4. Canopy hoods

While there is considerable overlapping or duplication in the foregoing grouping the distinction will become clear from the following discussion.

Enclosing Hoods

Contamination sources should be wholly or partially enclosed whenever possible. Enclosing hoods are more efficient than other types since the ineffective areas are closed off and disturbance by extraneous air currents is kept to a minimum. Examples of enclosing hoods are spray paint booths, laboratory hoods, luminous dial painting hoods, abrasive blasting cabinets, and some grinder hoods.

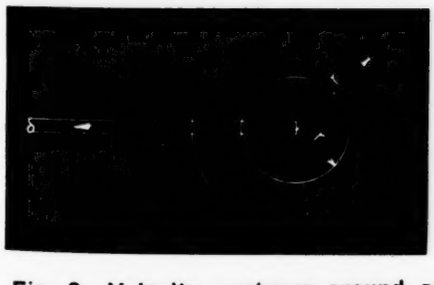


Fig. 2. Velocity contours around a hypothetical point source of suction.

Since the function of any exhaust hood is to create air movement of the proper magnitude and in the proper direction to capture the contaminant, it is obvious that adequate control will be accomplished if the minimum control velocity is created over all of the openings in the enclosing hood. Hence it is apparent that the following equation may be used to determine the quantity of air which must be exhausted from enclosing hoods.

$$Q = AV \qquad (1)$$

Where Q = the quantity of air in cfm
A = the total area in square feet of the openings into the hood.
V = the minimum control velocity in fpm (see Table 1)

Equation 1 shows at a glance that the required rate of air movement through the hood will be a minimum when the area of the openings into the hood is as small as is consistent with good performance.

The required ventilation rate for enclosing hoods for all conditions commonly encountered in industry may be conveniently read directly from Fig. 1 if the area of hood openings and minimum control velocity are known. For example, the quantity of air which must be exhausted from a spray paint booth (minimum control velocity, 200 fpm from Table 1) which has a hood opening of 7 ft x 4 ft (28 sq ft) is 5600 cfm.

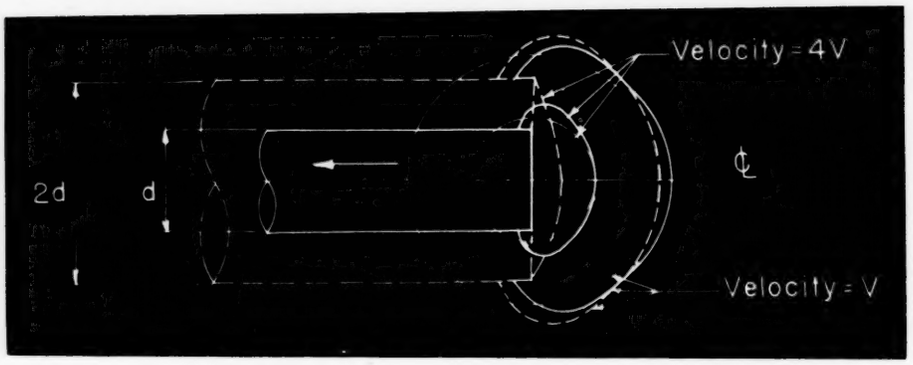
Rectangular or Round Hoods

These hoods are used at operations or locations such as welding; stone surfacing; down-draft in table tops for degreasing, cleaning, and cementing; drilling; and material transfer. They are the most inefficient type of hoods, as will be shown later, since in most applications a large percentage of the air entering the hood does not pass by the source or through the zone of contamination.

To understand fully the shape of the air velocity pattern in front of rectangular or round exhaust hoods, it is necessary to visualize a hypothetical point source of suction, Fig. 2. Under such conditions air would enter the suction point equally from all directions and the velocity contours would be spherical surfaces having their centers at the suction point. The total quantity of air entering the point source of suction could be determined if the air velocity were measured at any point x distance from the suction point, by the equation for the flow of fluids, namely:

$$Q = AV \qquad (2)$$

Where Q = the quantity of air in cfm
A = the area in square feet of the surface of the sphere having a radius of "x" feet
V = the air velocity in feet per minute at "x" dis-



——— Point source ——— Duct end having diameter d
— — — Duct end having diameter 2d

Fig. 3. Velocity contour comparison for point source and plain duct ends (Q remains constant).

tance from the suction point.

Since A is a spherical surface it is equal to $4\pi r^2$ (that is $4\pi x^2$) which equals $12.57x^2$. Hence equation 2 becomes

$$Q = 12.57x^2V$$

which we shall write as

$$Q = V\ (12.57x^2)$$

for comparison with equation 3.

Obviously the air flow pattern created by a freely suspended round or rectangular exhaust hood does not conform strictly to the hypothetical point source of suction (see Fig. 3). The contour shape was found by experiment to change slightly and to flatten directly in front of the hood as shown in Fig. 3. By studying the air flow characteristics of freely suspended round and rectangular hoods, Dalla Valle found that the center line air flow relationship may be expressed accurately by the following equation:

$$Q = V\ (10x^2 + a) \qquad (3)$$

Where Q = quantity of air exhausted in cfm
V = air velocity in fpm at x distance in feet from the hood and on the center line of the hood
x = distance in feet along the hood center line from the face of the hood to the point where the air velocity is V fpm.
a = area in square feet of the hood opening.

It should be noted that equation 2 defining the air flow relationship into a hypothetical point source of suction is almost the same as equation 3 which gives the center line air flow relationship for round or rectangular hoods, particularly if the hoods are small, since a then becomes relatively unimportant.

Equation 3 expresses the center line or axial velocity, not the velocity at any point in front of such hoods. However, the contours in front of freely suspended round or rectangular hoods are of such shape that equation 3 may be used to determine with sufficient accuracy the velocity at any point in front of the hood. To do this x should be measured in feet from the center of the plane of the hood opening for points at a relatively large distance from relatively small hoods (see Fig. 4). Where the source or area of contamination is at a relatively short distance from a relatively large hood, x should be measured perpendicular to the plane of the hood opening; it should not be measured from a point in the plane of the hood opening which is closer to the edge of the hood than twice the perpendicular dimension to the source or area of contamination (see Fig. 5). This method gives reliable data, particularly to the experienced engineer, and dispenses with the more cumbersome procedure of first plotting the approximate contours in front of the hood and then determining Q.

For the sake of convenience, these calculations are accomplished in Figs. 6 and 7 so that Q may be read directly after V, x, and a have been determined as discussed earlier under headings 1, 2, 3, and 4. In Fig. 6 the hood area in square feet and the value of x in inches are used to obtain a dimensionless reference value called the "hood-location-function". For circular hood openings such as duct ends, the area a need not be determined. Reference can be made directly to the duct diameter as shown at the top and to the left of Fig. 6. Using the "hood-location-function" and V, the value of Q may be read directly from Fig. 7.

For example, determine the quantity of air which must be exhausted through a plain end flexible metal tube 4 in. in diameter to create a control velocity of 100 fpm at a welding operation which is 9 in. away from the duct end. In Fig. 6 the 4-in. diameter line and the 9-in. distance line intersect at a hood-location-function value of about 5.7. In Fig. 7 the intersection of the 100 fpm velocity line and the 5.7-hood-location-function line is at a value of about 570 cfm. This is the value of Q. However, this value applies only to a freely suspended hood. If the end of the duct rests on a table top, some of the ineffective area is cut off and the value determined by equation 3 or by Figs. 6 and 7 may be reduced about 25%. Likewise, if a flange is used around the edge of the duct, some of the ineffective area will be cut off and the quantity of air needed to obtain the desired control velocity is decreased about 20%. Hence, if the operation is conducted on a table top and there is a 4-in. or 6-in. flange around the pipe end, the required exhaust rate is

$$570 - (143 + 85) = 342 \text{ cfm.}$$

Equation 3 shows that Q increases almost as the distance x^2. Consquently, the advantage of locating the hood as close as possible to the source of dust, fume, smoke, mist, gas or vapor is obvious. Fig. 6 demonstrates this fact for the benefit of those who do not have a clear picture of the rate of velocity decrease as the distance from the hood increases. Also a study of equation 3 and Figs. 6 and 7 will show that the minimum control velocity V is influenced almost solely by Q and very little by the velocity at the hood except where x is very small and a is relatively large. In other words, suction has little "directional reaching out power" in air. Nevertheless, it is a not infrequent practice by plant engineers to attempt to improve the control effected by local exhaust hood by increasing the hood velocity through decreasing its size. This does very little good, if any, except in very close proximity to the hood and frequently decreases the hood effectiveness by decreasing Q through increased hood resistance.

This same relationship applies to slot type hoods which will be covered

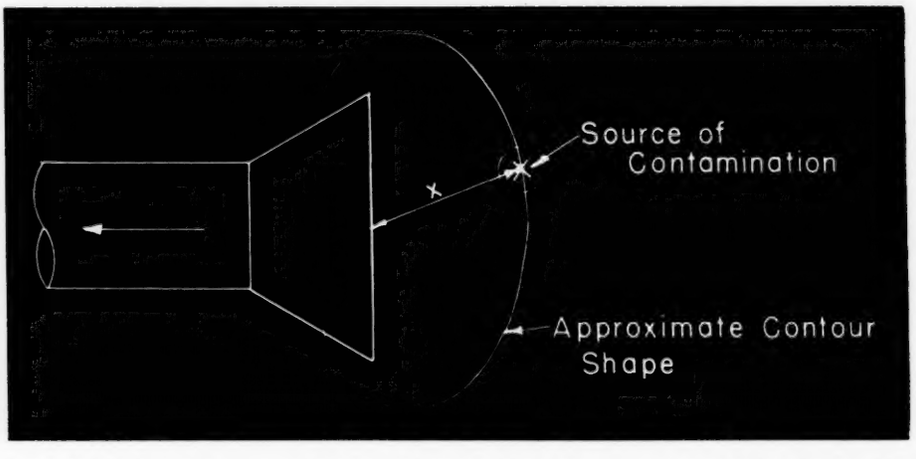


Fig. 4. Determining x under conditions where hood area is relatively small and x is relatively large.

later. Nevertheless, it is very common to see in print, reference to the ventilation rate of plating tanks, for instance, on the basis of a slot velocity of some definite value without defining the slot width. Slot velocity, per se, means little except very close to the slot. The minimum control velocity at some distance from the hood is a function of Q. Consequently, where the ventilation rate for slot type hoods is given in terms of the slot velocity, the slot *width* must be given also to define the actual ventilation rate.

It is obvious from equation 3 that for a constant Q, V varies inversely as the hood-location-function-value. Consequently, a study of Fig. 6 indicates that in general a small hood opening gives slightly better results than a larger one. This advantage is usually offset by the increased pressure loss at the hood entrance unless a flange is used at the smaller hood. Even though the entrance loss at a flanged duct end is greater than at a tapered hood of the same functional dimensions, the velocity pattern at the flanged duct end is better than at the tapered hood so that the overall design is better in most instances. (See Fig. 8.)

On the other hand, at those operations when the contaminant is released over a considerable area, it is advisable to have a large hood opening so that relatively flat velocity contours are created over the entire area rather than to have a high contour over part of the area and ineffective control near the edges of the area of contaminant release.

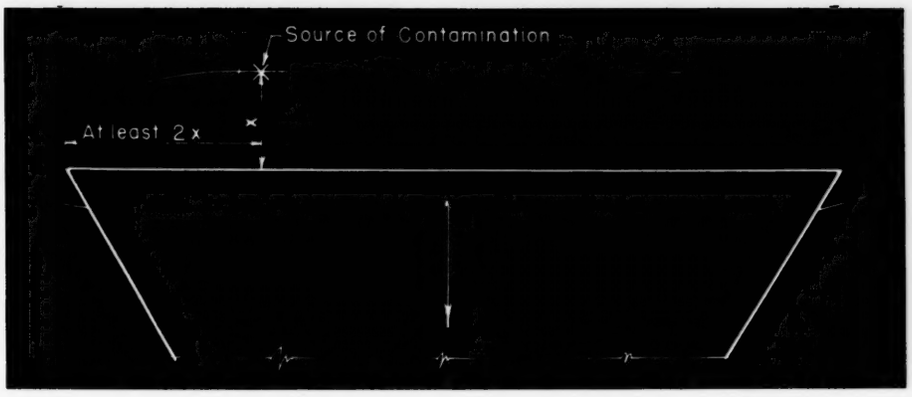


Fig. 5. Determining x under conditions where hood area is relatively large and x is relatively small.

Slot Hoods

These hoods are recommended for lateral exhaust ventilation at tanks or vessels such as are used for degreasing, pickling and plating; and at table tops or on flat surfaces where the contaminant is released over a considerable area.

Slot hoods are really an extreme form of rectangular hoods. The hood opening is relatively very long, up to 50 ft or more, and relatively very narrow, usually 4 in. or less. However, the air flow pattern into slot hoods as commonly found in industry is quite different from that into the more conventional form of rectangular hood, and it is for this reason primarily that the two are classified in separate groups.

To obtain a clear picture of the nature of air flow into slot type suction openings, it is necessary to visualize a line source of suction of infinite length (see Fig. 9). The velocity contours are obviously cylindrical surfaces with the line source of suction as the axis. Here again, the fundamental equation for the flow of fluids applies but A is the area of the surface of the cylinder or $2\pi rL$. Hence, equation 2 becomes

$$Q = 6.28rLV \qquad (4)$$

Where Q = rate of air flow in cfm
r = radius of cylinder in feet, or distance from source

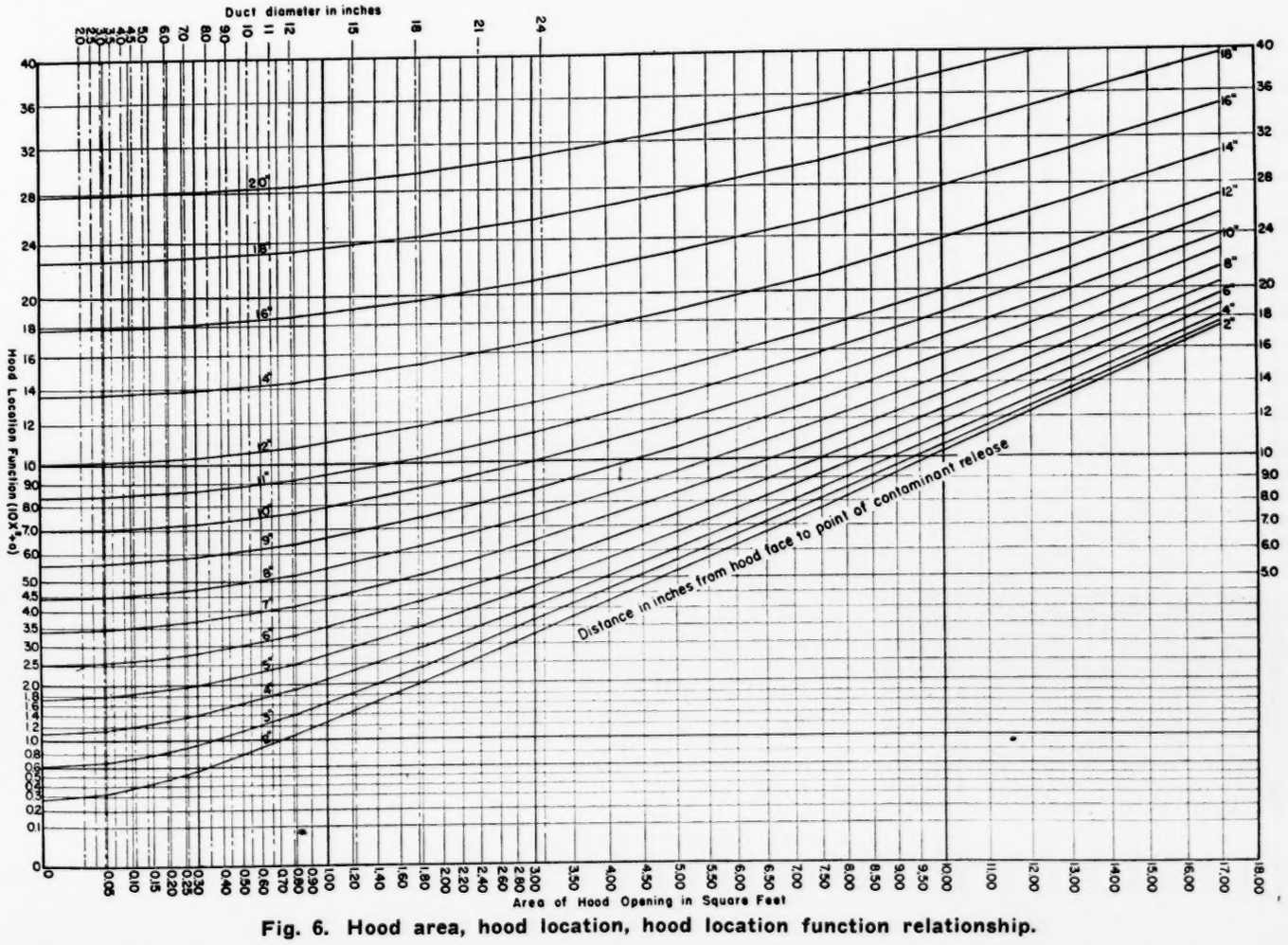

Duct diameter in inches
Hood Location Function (10X*o)
Area of Hood Opening in Square Feet
Distance in inches from hood face to point of contaminant release

Fig. 6. Hood area, hood location, hood location function relationship.

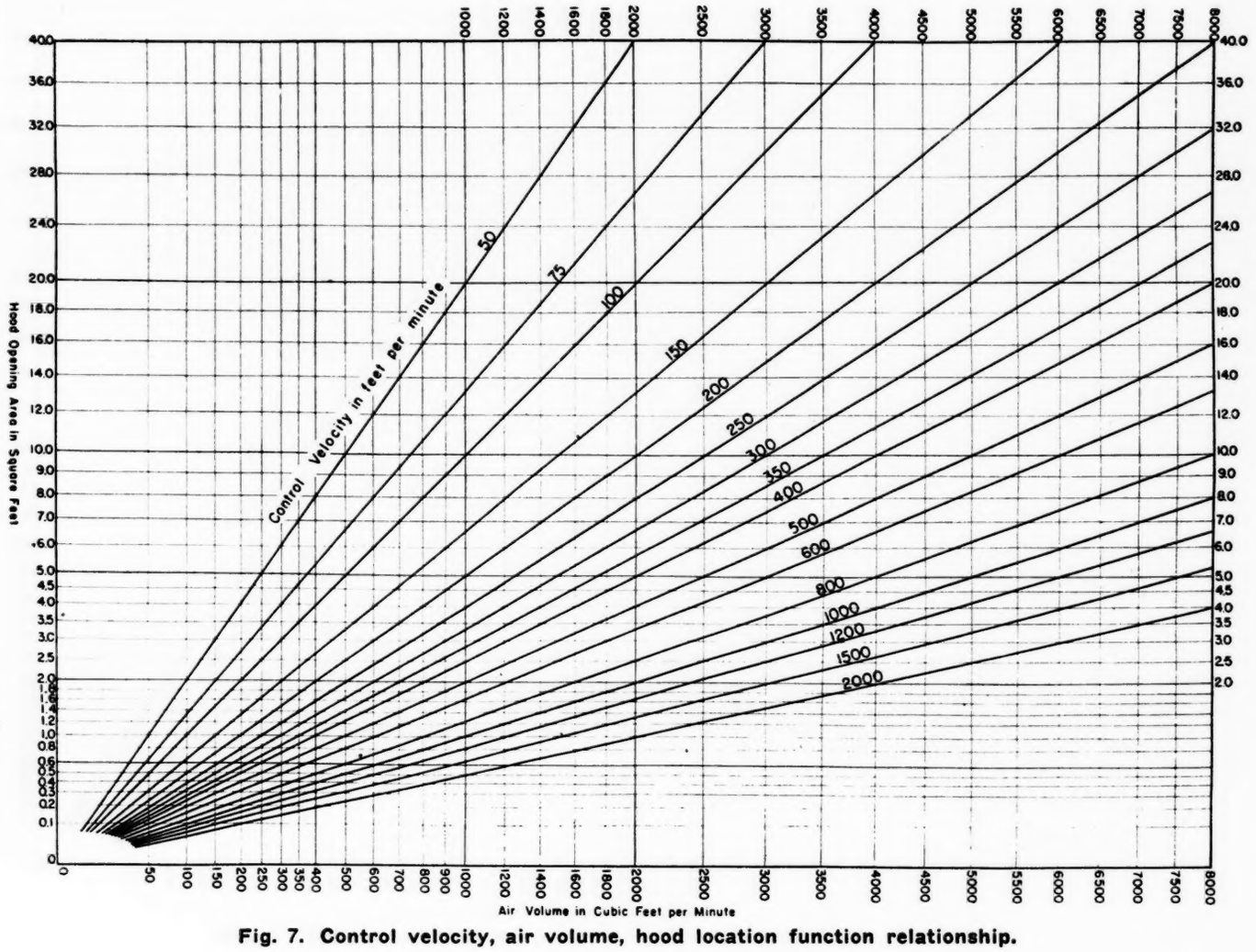


Fig. 7. Control velocity, air volume, hood location function relationship.

of suction to point where air velocity is V.

L = length of cylinder in feet

V = air velocity in fpm at distance r feet from source of suction.

Slot hoods in practice are not infinite in length and air does not enter uniformly from all directions. Nevertheless, where the length of the hood is great in comparison to the radius of the cylinders or the distance of the hood from the remotest source of contamination, the contours are very flat in the axial plane of the hood except at the ends (see Fig. 10). Also, while the contour surfaces are not cylinders, they approximate cylindrical surfaces but are only portions thereof depending upon the conditions under which the hoods are used. For example, a slot hood adjacent to a table top with a flange extending vertically is drawing air from only about ¼ of a cylinder. Hence, for slot hoods in general the following equation applies:

$$Q = kLWV \qquad (5)$$

Where Q = rate of air flow in cfm

k = constant varying from about 1.5 to 3.7 as will be explained later

L = length of hood in feet

W = table or tank width in feet (distance from hood to remotest source of contamination)

V = control velocity in fpm.

If the contours around a freely suspended slot hood were true cylinders k would be about 6.28 as shown in equation 4, but they are not. Silverman found k to have a value of 3.7 for freely suspended slot hoods. (This value appears to be lower than it should be but no data are available to the contrary.) For slot type hoods adjacent to tank tops Silverman gives k a value of about 2.8. As indicated previously, k will have a value of 1.5 if the hood has flanges or other restricting surfaces at right angles to each other so that air can enter from only one quadrant.

In Fig. 11 these data are plotted so that Q can be read directly if the table or tank dimensions are known. The three curves in Fig. 11 cover the usual conditions under which slot type hoods are used. Also, an arbitrary control velocity of 100 fpm is automatically included in Fig. 11. The first curve (Q = 150 LW) applies to slot hoods when used adjacent to a large flat surface such as a table top and when the hood has a wide flange at right angles to the flat surface. The second curve (Q = 280 LW) applies for similar conditions except without the flange. The third curve (Q = 370 LW) should be used for freely suspended slot hoods without flanges. Where a control velocity other than 100 fpm is needed, the value of Q as read from Fig. 11 must be changed proportionately.

It should be noted that equation 5 and Fig. 11 give values of Q which will produce the desired control velocity at the distance W from the hood. Between the hood and the limit defined by the distance W, the control velocity is considerably higher than at the distance W. Since it is not necessary in most instances to capture 100% of the contaminant, it is often permissible to use much lower control velocities than given in Table 1. For example, it has been found by experience that a ventilation rate of 120WL is satisfactory for chrome plating. In this instance, the control velocity at the far edge of the tank is only about 43 fpm but it is more than 100 fpm over almost half of the tank. In addition, dilution of the

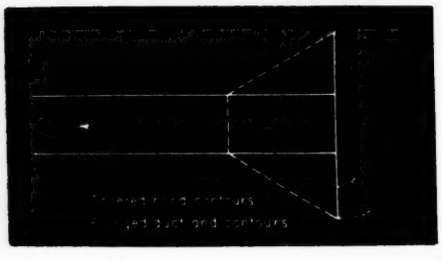


Fig. 8. Comparison of velocity contours at flanged duct end and at tapered hood of some functional dimensions.

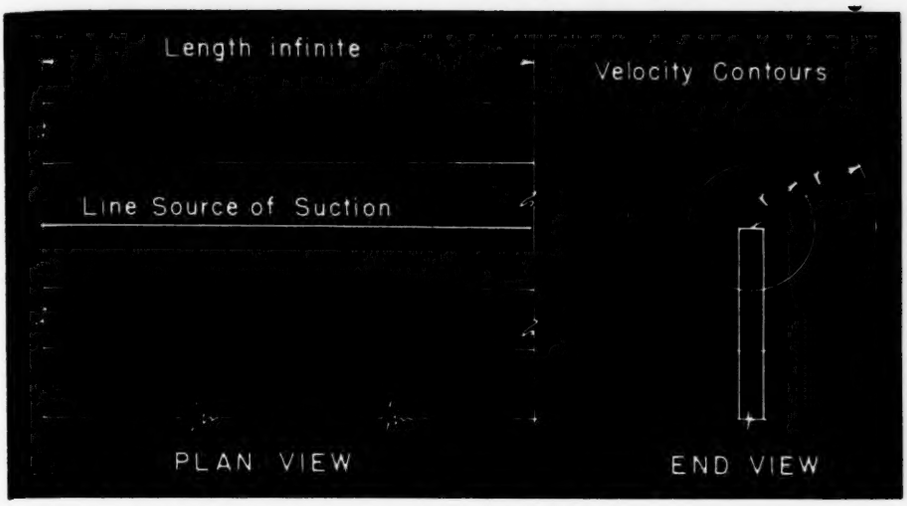


Fig. 9. Velocity contours around ahypothetical line source of suction.

contaminated workroom air by air exhausted through the hood is sufficient to keep the atmospheric concentration of chromic acid mist below the maximum allowable level.

Likewise for degreasing, the commonly used ventilation rate is 50WL. This produces a minimum control velocity of about 18 fpm. This ventilation rate is often found to be inadequate if there is any significant air disturbance near the tank. Higher ventilation rates, however, are avoided because of the excessive rate of solvent loss. Since little or no local exhaust ventilation is needed for degreasing if the tank is of good design and if the operation is performed properly, and since a very high ventilation rate is needed if these conditions are grossly violated there is no justification for increasing the recommended rate because of the economic problem involved.

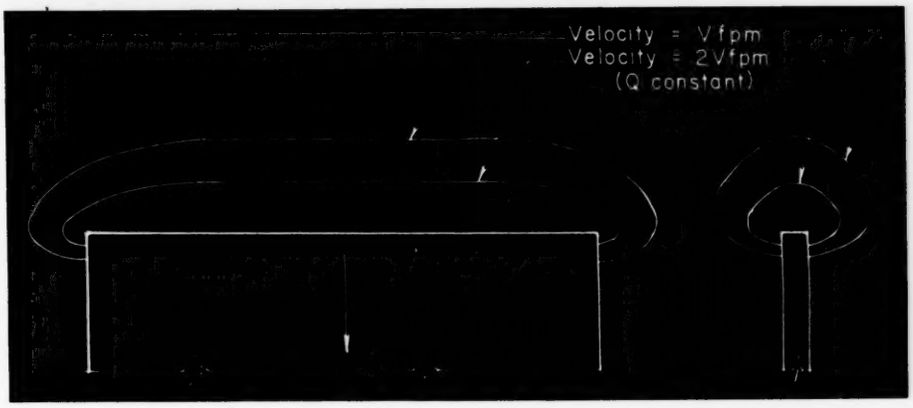


Fig. 10. Approximate shape of velocity contours in front of a freely suspended slot exhaust hood.

Canopy Hoods

Hoods of this type are used above tanks, tables, furnaces and the like (see Fig. 12). They are particularly

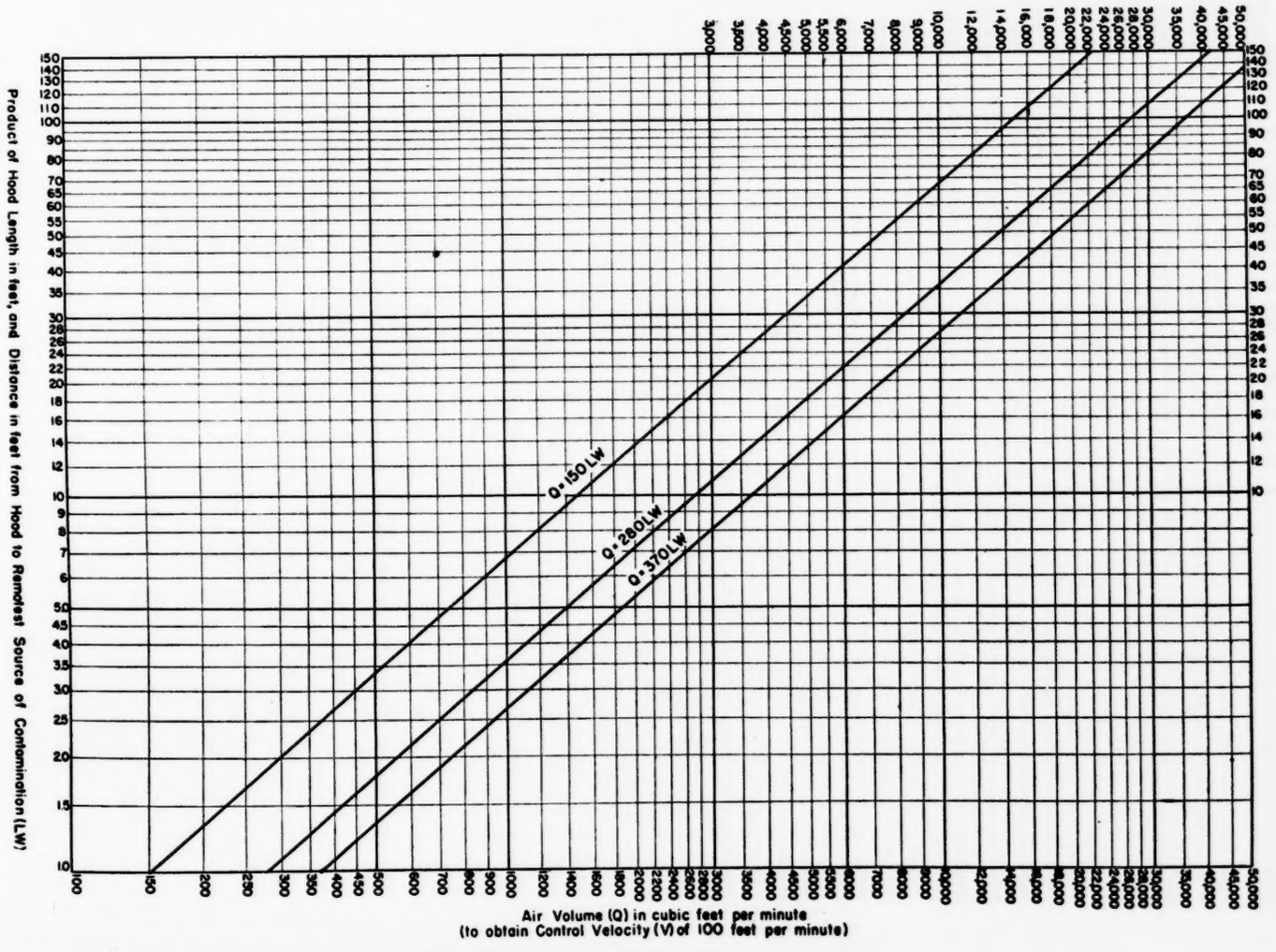

Q=150LW
Q=280LW
Q=370LW
Product of Hood Length in feet, and Distance in feet from Hood to Remotest Source of Contamination (LW)
Air Volume (Q) in cubic feet per minute
(to obtain Control Velocity (V) of 100 feet per minute)

Fig. 11. Air volume for slot type hoods.

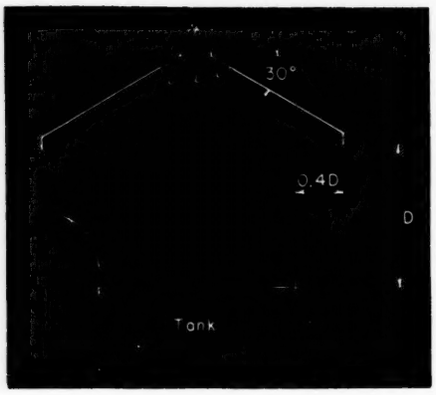


Fig. 12. Suggested canopy hood design.

satisfactory if the contaminated air is warmer than the room air and tends to rise. They should, however, not be used if the workers must lean over the source of contamination, because the contaminated air is merely drawn through the breathing zones of the workers. Canopy hoods were employed more widely in the past than they are today. A much too large percentage was employed on operations where the workers stood over the source of contamination. The trend today is to employ lateral or downdraft exhausts for jobs of this nature.

Canopy hoods are actually one class of rectangular or round hoods. However, their usual arrangement is such that the entering velocity pattern is markedly different from the conventional round or rectangular hood, and therefore, are considered as a separate group. Very little work has been reported on the nature of air flow into different types of canopy hoods. However, Fig. 12 shows the approximate shape of a velocity contour at a typical hood.

In applying the fundamental equation, it is obvious that A is the entire area of opening between the hood and the upper edges of the surfaces beneath the hood—approximately PD (see Fig. 12). V is the average velocity through the opening — not the velocity at the upper edge of the table or tank.

Thus $Q = PDV$ (6)

Where Q = quantity of air in cfm

P = perimeter of hood face in feet

D = perpendicular distance in feet from hood face to top of tank or table

V = average velocity through opening between hood edge and table or tank top

Since the minimum control velocity should exist at the upper edge of the table or tank the average velocity must be increased accordingly. Dalla Valle found that for canopy hoods of the approximate proportions shown in Fig. 12 and located about 3½ or 4 ft above the source of contamination, the velocity at the top edge of the tank or table was about 0.7 of the average velocity. Hence the equation defining the minimum ventilation rate in terms of the minimum control velocity becomes:

$Q = 1.4\ PDV$ (7)

Where Q, P and D are the same as in 6, and

V = the minimum control velocity in fpm.

It should be observed, however, that equation 7 applies only to canopy hoods as shown in Fig. 12 and as

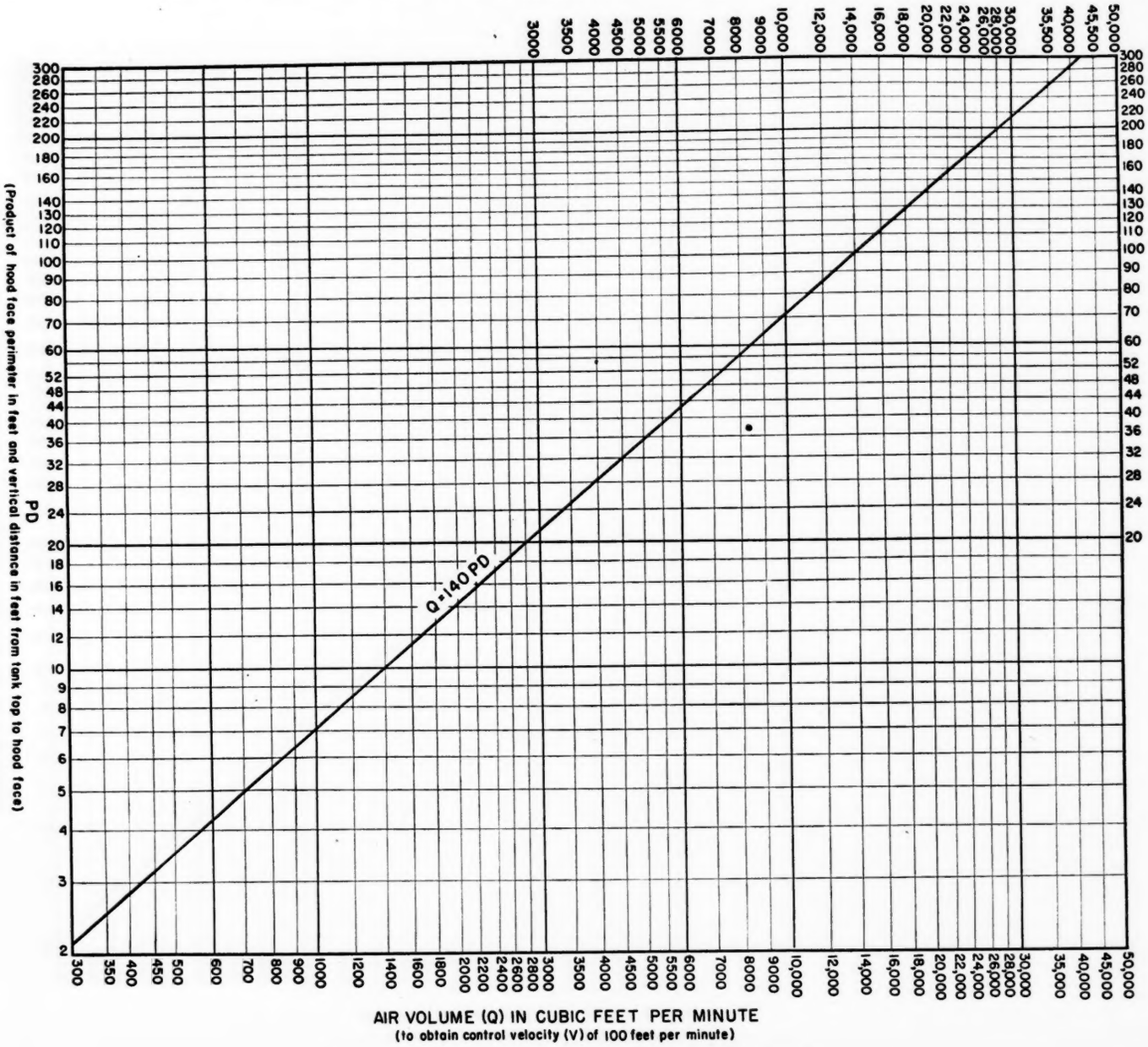

Q=140 PD
PD
(Product of hood face perimeter in feet and vertical distance in feet from tank top to hood face)
AIR VOLUME (Q) IN CUBIC FEET PER MINUTE
(to obtain control velocity (V) of 100 feet per minute)

Fig. 13. Air volume required for canopy hoods.

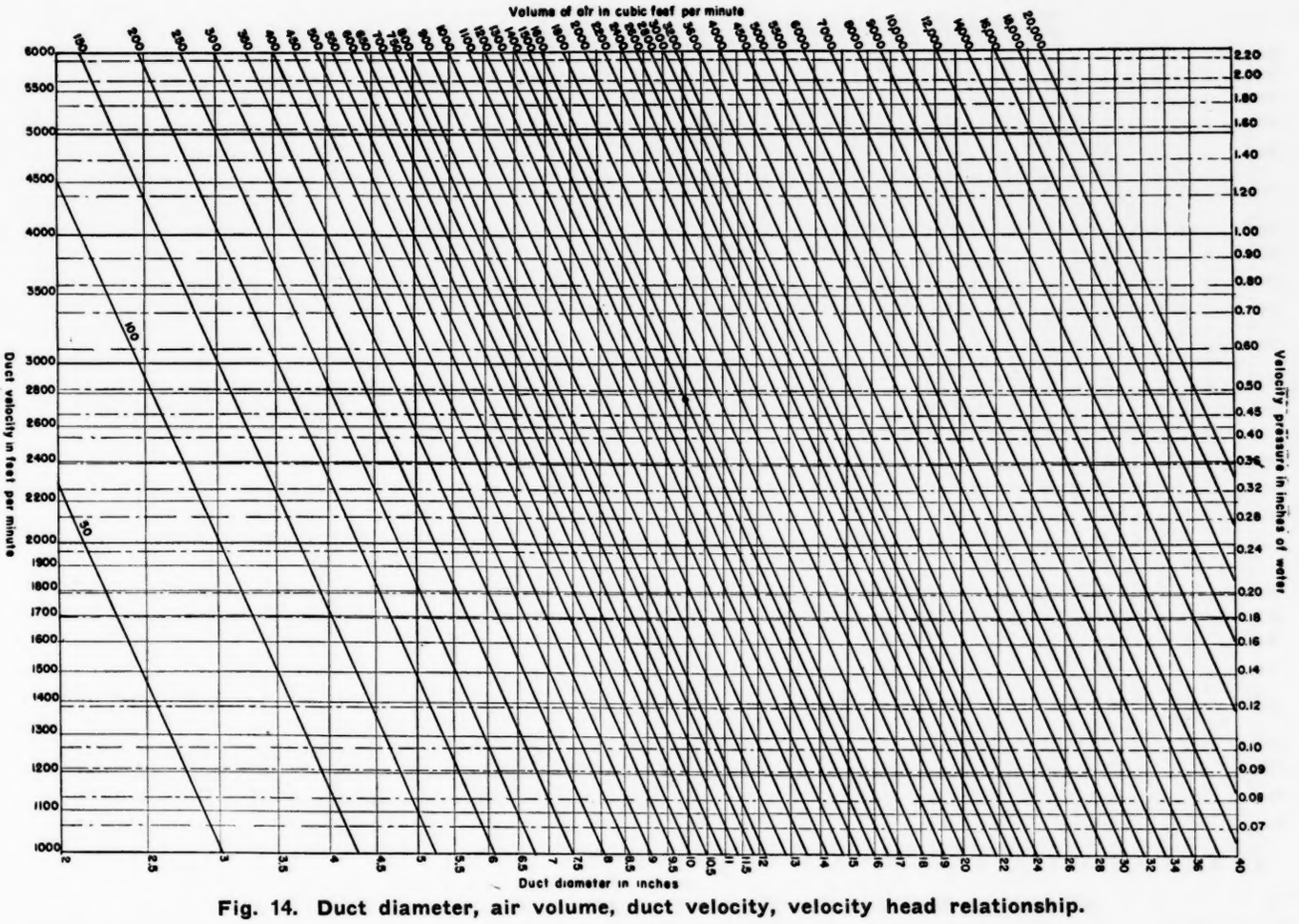

Volume of air in cubic feet per minute
Duct velocity in feet per minute
Velocity pressure in inches of water
Duct diameter in inches
100
50

Fig. 14. Duct diameter, air volume, duct velocity, velocity head relationship.

commonly found in industry. The constant will be as low as 1.0 if the canopy hood is only a negligible distance from the surface at which the contamination arises and will be greater than 1.4 if the distance between the hood and source of contamination is excessive.

Equation 7 is plotted in Fig. 13 so that the required ventilation rate may be read directly if the area of the opening *PD* is known and the minimum control velocity is 100 fpm. For different control velocities the value of *Q* must be changed proportionately but for most operations where canopy hoods are used a control velocity of 100 fpm is adequate.

DESIGNING THE DUCT

The second major step in the design of a local exhaust system is the design of ductwork connecting the hoods to the exhauster. Three important objectives to be gained by careful duct design are (1) a balanced system, (2) proper transport velocities in all ducts, and (3) minimum power consumption.

To obtain a balanced system, it is necessary that the ductwork upstream from the exhauster be of such size that the total pressure TP (negative) at every junction be the same for both ducts extending upstream from the junction. Obviously, it is impossible to have a TP of 2-in. of water at the point in a main duct where a branch duct enters and to have only 1-in. TP in the downstream end of the branch duct. For this reason it is unwise to exhaust operations producing widely dissimilar materials by a single system. It is better to use separate systems for the different types of contaminant to be handled.

Ductwork design for a local exhaust system entails the calculation of the TP in both ducts at all points of junction and the altering of duct sizes upstream thereof as necessary to accomplish a balance. An inspection of the ductwork layout will reveal which branch duct is located most unfavorably. It is usually the one most remote from the exhauster. Design calculations should be started with the branch having the greatest resistance and the other parts of the system should be proportioned accordingly. The TP must be determined for each duct section lying upstream from each junction or point where *Q* changes. The various steps in the design of a complete duct system for a typical layout will be demonstrated later in a sample calculation.

The TP of a single branch duct is made up of the velocity pressure VP and the resistance pressure RP. The RP is a measure of energy loss involved in moving air through the hood, duct, and accessories, and is comparable to the frictional resistance involved in moving any object or material. It is made up of the resistance at the hood, the resistance in the straight duct, the resistance in the bends, the resistance in enlargements or contractions, the resistance in any other restrictions such as chip traps or dust collectors, and the resistance at the entrance to the main duct.

The steps involved in the calculation of the TP of a branch duct are covered in the eight numbered sections which follow:

1—Transport Velocity. In local ex-

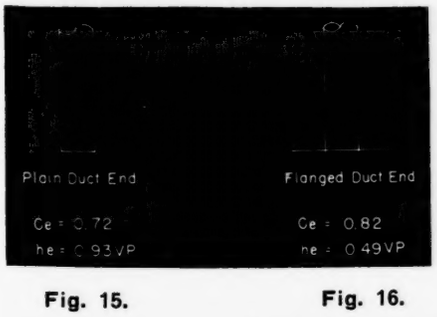


Fig. 15. **Fig. 16.**

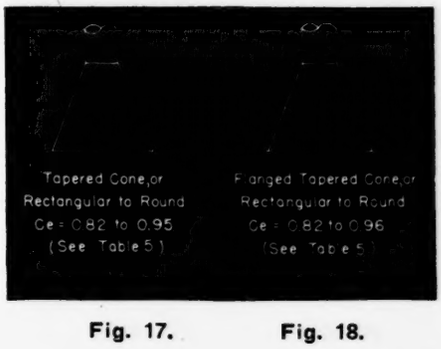

Tapered Cone or Rectangular to Round
Ce = 0.82 to 0.95
(See Table 5)
Flanged Tapered Cone or Rectangular to Round
Ce = 0.82 to 0.96
(See Table 5)

Fig. 17. **Fig. 18.**

TABLE 2.—RECOMMENDED MINIMUM DUCT VELOCITIES

Nature of Contaminant	Examples	Duct Velocity—fpm
Vapors, gases, smokes, fumes, and very light dusts	All vapors, gases, and smokes; zinc and aluminum oxide fumes; wood flour and cotton lint.	2000
Medium density dry dusts	Cotton, buffing and jute lint; wood, grain, rubber, and bakelite dust.	3000
Average industrial dust	Wool; wood, sand blast, grinding, and shoe dust; wood shavings.	4000
Heavy dusts	Lead, and foundry shake-out dusts; metal turnings; jute butts.	5000
Large particles, of heavy, moist materials	Moist lead or foundry dust.	5000 and over

haust systems the determining factor as regards the minimum duct velocity is the nature of the contaminant to be transported. Duct velocities vary from as little as 1500 or 2000 fpm for gases or vapors to as much as 5500 for heavy dusts like lead. As a rule the velocity is kept as low as is consistent with good conveyance of the contaminant to conserve power consumption, but infrequently it is preferable to employ higher duct velocities and smaller duct sizes to accomplish a better structural design —that is, fewer elbows and offsets, or less interference with workers and equipment.

The minimum velocity necessary for transport of the contaminant may be computed by means of the following equation but it is more convenient to use Table 2 which lists duct velocities commonly used for different contaminants:

$$V = 15.700\left(\frac{S}{S+1}\right)\sqrt{p} \quad (8)$$

Where V = duct velocity in fpm
S = specific gravity of the contaminant
p = particle diameter in inches

That it is not good practice to exhaust unlike materials in the same system is apparent from the duct velocities recommended in Table 2 for transporting different types of contaminants. To balance the system the resistance in the section handling vapors, for example, the resistance must be of the same order of magnitude as the resistance in the branch handling the material hard to transport such as coarse lead dust. Since the power consumption varies approximately as the cube of the duct velocity, such arrangement is very wasteful of power even though economical to install.

2—Velocity Pressure. Since ductwork is usually constructed only to standard sizes, such as the ½-in. for small circular ducts and the even inch for larger ones, it is necessary to calculate the true duct velocity using the minimum transport velocity as a guide. For branch ducts, the nearest smaller standard size is commonly selected so that the transporting velocity will not fall below the desired value. Pipe area may be computed by means of the following equation:

$$A = \frac{Q}{V} \quad (9)$$

Where A = the duct area in square feet
Q = the quantity of air in cfm
V = minimum transport velocity in fpm.

From *A* the duct diameter, or dimensions if rectangular, can be determined. For round pipe, however, diameter can be computed directly by:

$$d = 13.5\left(\frac{Q}{V}\right)^{0.5} \quad (10)$$

Where d = the duct diameter in inches
Q and V are the same as in 9

Unless the value of *d* happens to be only slightly above a standard size, the next smaller size pipe is selected and the actual duct velocity is determined by solving for *V* in equation 9 or for round ducts by:

$$V = \frac{183Q}{d^2} \quad (11)$$

Where V = the average duct velocity in fpm
Q = the quantity of air in cfm
d = the diameter of the duct in inches

The velocity pressure may then be calculated by:

$$VP = \left(\frac{V}{4005}\right)^2 \quad (12)$$

Where VP = the velocity pressure in inches of water
V = the average duct velocity in fpm

For the sake of convenience, the velocity pressures for different velocities have been tabulated in Table 3. Areas of round pipes in sq ft for different standard diameters in inches have been tabulated in Table 4. Also since Fig. 1 is a plot of the interrelationship of *Q*, *V*, and *A* it can be used to read direct the data given by equation 9. However, all of these data have been plotted on one graph in a very convenient form to speed the calculations (see Fig. 14).

Example: Determine the duct size the true velocity, and the VP for a duct to handle 1000 cfm, the duct to have a minimum transport velocity of 3000 fpm.

Solution: Select the 1000 cfm line at the top of Fig. 14 and follow it diagonally downward to the 3000 fpm duct velocity line (see left of figure for duct velocity). The exact pipe diameter is read as about 7.8 in. Select the next smaller standard duct 7.5 in., follow it vertically to the 1000 cfm line, and read the true velocity, about 3250 fpm. Follow the dot-and-dash line to the right, and read the VP, 0.66-in. water gage. Thus very rapidly, and in one more or less continuous movement, these calculations are accomplished.

3—Hood Entrance Loss. Energy loss or resistance at hood entrances varies widely depending upon the shape of hood. This loss is due largely to contraction of the air stream as it

TABLE 3.—VELOCITY PRESSURES FOR DIFFERENT VELOCITIES

(Tabular Solution of Equation 12)

(Velocity V in fpm and Velocity Pressure VP in inches of water)

VP	V	VP	V	VP	V	VP	V	VP	V
.06	981	.50	2832	.94	3884	1.38	4705	1.82	5403
.08	1133	.52	2888	.96	3924	1.40	4739	1.84	5433
.10	1266	.54	2943	.98	3965	1.42	4773	1.86	5462
.12	1387	.56	2997	1.00	4005	1.44	4806	1.88	5491
.14	1498	.58	3050	1.02	4045	1.46	4840	1.90	5521
.16	1602	.60	3102	1.04	4084	1.48	4873	1.92	5550
.18	1699	.62	3153	1.06	4123	1.50	4905	1.94	5579
.20	1791	.64	3204	1.08	4162	1.52	4938	1.96	5608
.22	1879	.66	3254	1.10	4200	1.54	4970	1.98	5637
.24	1962	.68	3303	1.12	4238	1.56	5002	2.00	5664
.26	2042	.70	3351	1.14	4276	1.58	5034	2.02	5692
.28	2119	.72	3398	1.16	4314	1.60	5066	2.04	5720
.30	2193	.74	3445	1.18	4350	1.62	5098	2.06	5748
.32	2260	.76	3491	1.20	4386	1.64	5129	2.08	5776
.34	2335	.78	3537	1.22	4423	1.66	5160	2.10	5804
.36	2403	.80	3582	1.24	4460	1.68	5191	2.12	5831
.38	2469	.82	2625	1.26	4495	1.70	5222	2.14	5859
.40	2533	.84	3669	1.28	4531	1.72	5253	2.16	5886
.42	2595	.86	3709	1.30	4566	1.74	5283	2.18	5913
.44	2656	.88	3758	1.32	4601	1.76	5313	2.20	5940
.46	2716	.90	3800	1.34	4636	1.78	5343	2.22	5967
.48	2775	.92	3842	1.36	4671	1.80	5374	2.24	5994

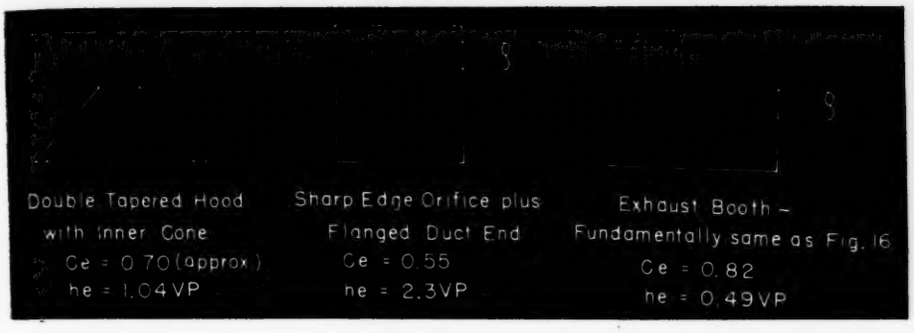


Fig. 19.

Fig. 20.

Fig. 21.

enters the hood throat. The greater this contraction, that is the lower the percentage of the hood throat area actually occupied by the air stream, the lower is the coefficient of entrance C_e and the greater is the energy loss at entrance. The coefficient of entry will vary from as low as about 0.6 for a sharp edged orifice to as high as 1.0 for a streamlined, bell-shaped entrance. Figs. 15 to 27 inclusive show different typical hood shapes with the corresponding coefficients of entry and the energy loss in terms of the VP at the throat of the hood. C_e for tapered hoods will vary with the proportions of the hood. In Table 5 are given different coefficients of entry for tapered hoods of different proportions. The method of determining the included angle

or the ratio $\frac{L}{D-d}$ is illustrated in Fig. 28.

If the coefficient of hood entry is known (use Figs. 15 to 27 as a guide) the hood entrance loss h_e in percent of the VP at the hood throat may be determined by means of the following equation:

$$h_e = \left(\frac{1 - C_e^2}{C_e^2}\right) VP \quad (13)$$

Where h = hood entrance loss in inches of water
C_e = coefficient of hood entry
VP = velocity pressure at hood throat in inches of water

Hood entrance losses in percent of the VP's for different entry coefficients are tabulated in Table 6 for which they may be read conveniently.

Types and shapes of hoods encountered in industry today are many and varied. Some are quite complicated so that it is merely guesswork to attempt to choose an over-all coefficient of entry. However, most complex hoods can be broken down into a series of individual hoods, the coefficients of entry of which can be estimated individually by reference to Figs. 15 to 27 inclusive. The over-all C_e can be computed by determining from Figs. 15 to 27 and Tables 5 and 6 the individual VP's, adding them, and then from Table 6 obtaining the composite C_e. For example, the hood shown in Fig. 20 is similar to a succession of the two hoods shown in Figs. 16 and 23. The VP's of these hoods are 0.49 and 1.78 which total 2.27. From Table 6 the composite C_e is found to be 0.55.

4—Bends — Straight Duct Equivalent. Energy loss or resistance pressure for bends is not the same as for a similar length of straight duct but can be expressed conveniently in terms of the length in feet of straight duct which has the same RP. The RP varies for bends with the degree of curvature and with the amount of bend. The equivalent length of straight duct for different bends may be calculated by means of the following equation:

$$EDL = KSd^{1.2} \quad (14)$$

Where EDL = equivalent length of straight duct in feet
K = a constant which varies with the degree of curvature (radius of bend) as shown in Table 7.
S = the angle of bend in degrees
d = the duct diameter in inches

It is good practice to construct all bends with a center line radius of at least 2½ pipe diameter. The equivalent straight duct in feet for different bends having a radius of bend of 2½d and for different sizes of duct are tabulated in Table 8 to simplify the design calculations. For other degrees of curvature the values selected from Table 8 must be multiplied by an appropriate factor as shown in Table 9. The equivalent straight duct length of bends greater than 90 deg. may be computed by equation 14 or by increasing the 90 deg. value from Table 8 proportionally.

5—Resistance Pressure of Straight Ducts. To calculate the RP of the ductwork including the bends, the total length in feet of straight duct in the branch to the point of junction with another duct is determined and to this is added the equivalent length in feet of straight ducts as found in step 4 for the bends. The length, if significant, of the converging or diverging sections as given under 6 should be included in the straight duct length. The RP can be computed by using the following equation:

$$RP = \frac{0.058LQ^{1.91}}{Cd^5} \quad (15)$$

Where RP = the duct resistance pressure in inches of water
L = the total length in feet of ducts including the straight duct equivalent of the bends
Q = quantity of air in cfm

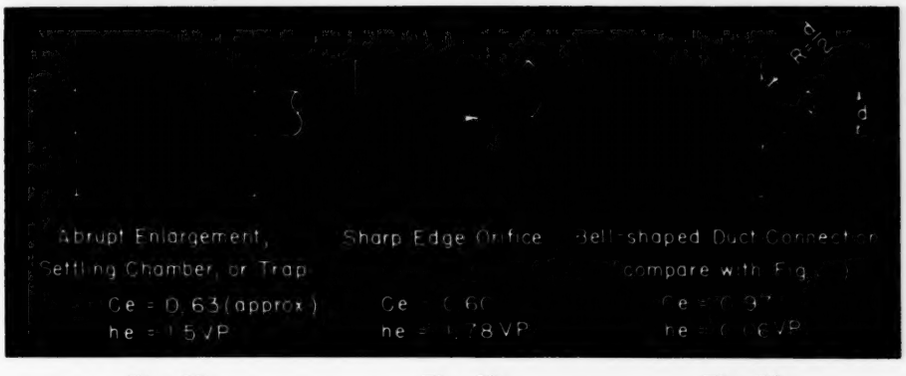


Fig. 22.

Fig. 23.

Fig. 24.

TABLE 4.—DUCT AREAS—ROUND DUCTS

Duct Diameter, In.	Duct Area, Sq Ft	Duct Diameter, In.	Duct Area, Sq Ft	Duct Diameter, In.	Duct Area, Sq Ft	Duct Diameter, In.	Duct Area, Sq Ft
2	0.0218	10	0.5454	18	1.767	32	5.585
2½	0.0341	10½	0.6010	18½	1.867	33	5.940
3	0.0491	11	0.6600	19	1.969	34	6.305
3½	0.0668	11½	0.7215	19½	2.074	35	6.681
4	0.0873	12	0.7854	20	2.182	36	7.069
4½	0.1104	12½	0.8520	21	2.405	37	7.467
5	0.1364	13	0.9218	22	2.640	38	7.876
5½	0.1650	13½	0.9937	23	2.885	39	8.296
6	0.1964	14	1.069	24	3.142	40	8.727
6½	0.2304	14½	1.146	25	3.409	42	9.621
7	0.2673	15	1.227	26	3.687	44	10.56
7½	0.3068	15½	1.310	27	3.976	46	11.54
8	0.3491	16	1.396	28	4.276	48	12.57
8½	0.3942	16½	1.485	29	4.587	50	13.64
9	0.4418	17	1.576	30	4.909	55	16.50
9½	0.4923	17½	1.670	31	5.241	60	19.63

TABLE 5.—COEFFICIENTS OF ENTRY FOR TAPERED OR BELL-SHAPED HOODS OF DIFFERENT PROPORTIONS

Included Angle (s) In Deg. (See Fig. 28)	Ratio $\frac{L}{D-d}$ (See Fig. 28)	Ratio $\frac{\text{Hood Face Area}}{\text{Duct Area}}$ 5 or More	4	3	2	1	
Unflanged Tapered or Bell-Shaped Hoods (Fig. 17)							
10	5.7	0.95	0.94	0.93	0.89	No angle—plain pipe end	0.72
20	2.7	0.92	0.91	0.90	0.87		
30	1.7	0.89	0.88	0.87	0.86		
40	1.2	0.87	0.86	0.85	0.85		
60 or more	0.60 or less	0.82	0.82	0.82	0.82		
Flanged Tapered or Bell-Shaped Hoods (Fig. 18)							
10	5.7	0.96	0.96	0.95	0.93	No angle—flanged pipe end	0.82
20	2.7	0.93	0.93	0.92	0.91		
30	1.7	0.90	0.90	0.90	0.90		
40	1.2	0.89	0.89	0.89	0.88		
60 or more	0.60 or less	0.82	0.82	0.82	0.82		

TABLE 6.—PRESSURE LOSS AT HOOD ENTRANCE IN PERCENT OF VELOCITY PRESSURE AT THROAT FOR DIFFERENT COEFFICIENTS OF ENTRY (Tabular Solution of Equation 13)

Coefficient of Entry	Hood Entrance Loss in % of Velocity Pressure at Throat	Coefficient of Entry	Hood Entrance Loss in % of Velocity Pressure at Throat	Coefficient of Entry	Hood Entrance Loss in % of Velocity Pressure at Throat
1	0	0.83	45	0.66	130
0.99	2.0	0.82	49	0.65	137
0.98	4.2	0.81	52	0.64	144
0.97	6.4	0.80	56	0.63	152
0.96	8.7	0.79	60	0.62	160
0.95	11	0.78	65	0.61	169
0.94	13	0.77	69	0.60	178
0.93	16	0.76	73	0.59	187
0.92	18	0.75	78	0.58	197
0.91	21	0.74	83	0.57	208
0.90	23	0.73	88	0.56	219
0.89	26	0.72	93	0.55	230
0.88	29	0.71	98	0.54	242
0.87	32	0.70	104	0.53	256
0.86	35	0.69	110	0.52	270
0.85	38	0.68	116	0.51	285
0.84	42	0.67	123	0.50	300

C = coefficient of roughness from Table 10
d = duct diameter in inches

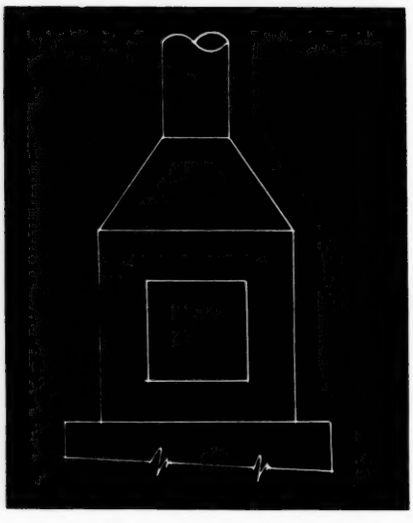


Fig. 25. Hood, as over lead pot, low face velocity. Fundamentally the same as Fig. 17. Ce 0.82 to 0.95 (see Table 5).

The foregoing equation gives the RP in inches of water but as will be shown later the design calculations involved in balancing a system are simplified considerably if all energy losses in branch ducts are expressed in terms of the VP. To accomplish this, equation XV can be converted to the following form:

$$L = 0.0365CdQ^{0.09} \qquad (16)$$

Where L = length in feet of duct which will have an energy loss RP of one VP
C = coefficient of roughness from Table 10
d = duct diameter in inches
Q = quantity of air in cfm

Values obtained from the foregoing equation are tabulated in Table 11 for different duct sizes and types of ductwork, from which the length of duct in feet which has an RP of one VP may be read directly. It should be noted that values in the table are for a transporting velocity of about 4000, and introduce only a negligible error for velocities from 2000 to 5500 fpm. The RP of the total length of duct in a branch, or section of main duct, in terms of VP is then determined by dividing L from Table 11 into the total duct length in feet.

Round ducts are preferred and should be used in local exhaust systems wherever practicable. Nevertheless, it is sometimes necessary to use rectangular ducts. This introduces an additional step in calculating the RP of the ductwork. The recommended procedure is to determine the diameter of the equivalent round duct and then to employ the tables, figures, and equations for round ducts. This may be done by using the following equation:

$$d = 1.075\sqrt{xy} \qquad (17)$$

Where d = diameter of equivalent round duct in inches
x and y = the dimensions in inches of the rectangular duct.

Equation 17 is plotted in Fig. 29 enabling the designer to read directly the equivalent round duct diameter for most of the duct sizes encountered in industrial local exhaust systems. For example, referring to Fig. 29, a rectangular duct 12-in. by 18-in. (216 sq in.) is found to be equivalent to a 16-in. diameter duct.

6—Other Energy Losses. Equipment such as chip traps, settling chambers, dust collectors, and the like, are frequently found in local exhaust systems. Such equipment introduces additional pressure losses which must be determined and included in the total RP of the section in which it is located. Duct enlargements or contractions are frequently necessary to make connection to equipment such as fans or collectors which have standard size apertures at the inlet and outlet. They are found, only too frequently, in main ducts at ill-chosen places to increase the duct area to accommodate increases in Q, and infrequently in branch ducts for no good reason. Enlargements or contractions are necessary at standard equipment but can seldom be justified elsewhere except at the points where branches enter main ducts. The theoretical gain in RP in well designed transformation pieces in main ducts where branches enter is offset by the turbulence of the entering air stream and can therefore be omitted from the calculations.

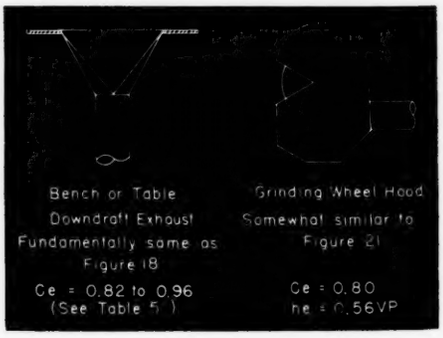


Fig. 26. **Fig. 27.**

TABLE 7. — VALUES OF K IN EQUATION 14 FOR BENDS OF DIFFERENT RADII

Ratio of Radius of Bend In. to Duct Diam. In.	Value of K in Equation 14
1	0.0273
1¼	0.0195
1½	0.0140
1¾	0.0109
2	0.0094
2¼	0.0086
2½	0.0078
2¾	0.0086
3	0.0094

The energy loss or RP for collectors, washers or similar equipment should be obtained from the manufacturer to be used in calculating the total RP. The RP for traps or sudden enlargements is about 1.5 VP (see Fig. 22 and Table 12).

Energy loss in enlargements or contractions varies with the rate of change. If the rate of change in enlargements is very slow there is theoretically a gain in RP resulting from the conversion of the VP to RP. Such gain occurs, however, only if the included angle (see Fig. 28) is very small, which seldom occurs in local exhaust systems on the upstream side of the exhauster, and can therefore be omitted from consideration without jeopardizing the design calculations. Losses for enlargements and contractions may be read directly from Table 12 for different degrees of change as determined by the use of Fig. 28.

In discharge stacks it is advantageous to enlarge the diameter slowly and thereby accomplish a slight gain in RP proportional to the decrease in VP. For an included angle of 7 deg. or less a gain in RP of about 83% of the decrease in VP will result. To this must be added algebraically the RP caused by the duct or discharge stack which is determined as given under 5, to determine the RP for the stack.

7—Main Duct Entrance Loss. The final energy loss in a branch duct is that caused by its entrance into the main duct. The RP at this point varies with the angle at which the branch duct enters the main (see Table 13 and Fig. 30). The included angle should never exceed 45 deg. and should preferably be 30 deg. or less. The RP for the main duct entrance loss may be read directly from Table 13 in terms of the VP existing in the branch.

8—Total Pressure. The TP for the branch duct is the sum of the individual RP's found under 3, 5, 6, and 7 in terms of the VP plus 1.0 VP as found under 2. Since the TP of the branch where it enters the main must be the same as the TP existing in the main at the point where the branch enters, the TP for the branch in terms of its VP may be calculated easily and from it the actual *V*. If this is significantly greater, or smaller, than that determined under 2, as may be the case for the branches entering the main close to the exhauster, the duct size should be recalculated to accomplish a balance. It should be noted that the only item of resistance which will be affected significantly in terms of the VP is the duct RP; hence only the calculations under 4, 5, and possibly 6 need be repeated. The other and less desirable method of balancing the system is to install dampers or blast gates in the branches near the main duct to increase the resistance but this procedure introduces an important maintenance problem, and besides the plan is wasteful of duct material.

The TP at any point in the main is the sum of the RP's of all sections lying upstream therefrom plus the TP existing in the most remote branch.

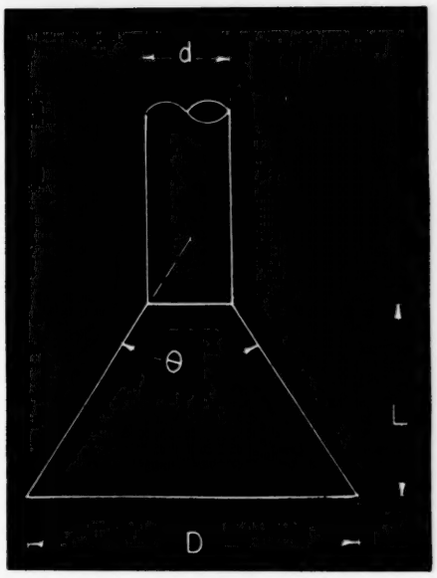


Fig. 28. Included angle for hoods, and duct enlargements or contractions.

TABLE 8.—RESISTANCE TO AIR FLOW IN ELBOWS AND BENDS
CENTER LINE RADIUS OF BEND = 2.5d
(EDL = $0.00780d^{1.2}$)

Duct Diameter, Inches	Degree of Bend					Duct Diameter, Inches	Degree of Bend				
	15	30	45	60	90		15	30	45	60	90
	Equivalent Duct Length, Ft.						Equivalent Duct Length, Ft.				
3	0.4	0.9	1.3	1.7	2.6	13	2.6	5.1	7.7	10.4	15.4
3.5	0.5	1.0	1.6	2.1	3.1	14	2.9	5.6	8.4	11.3	16.9
4	0.6	1.2	1.8	2.4	3.6	15	3.2	6.1	9.2	12.3	18.4
4.5	0.7	1.4	2.1	2.8	4.2	16	3.4	6.6	9.9	13.3	19.9
5	0.8	1.6	2.4	3.2	4.8	17	3.7	7.2	10.7	14.3	21.5
5.5	0.9	1.8	2.7	3.6	5.4	18	3.9	7.7	11.4	15.3	23.0
6	1.0	2.0	3.0	4.0	6.0	19	4.2	8.2	12.2	16.3	24.5
6.5	1.1	2.2	3.3	4.4	6.6	20	4.4	8.7	13.0	17.3	26
7	1.2	2.4	3.6	4.8	7.2	21	4.7	9.2	13.8	18.4	28
7.5	1.3	2.6	3.9	5.2	7.8	22	4.9	9.7	14.5	19.4	29
8	1.4	2.8	4.2	5.6	8.5	23	5.2	10.2	15.3	20.4	31
8.5	1.5	3.0	4.5	6.1	9.2	24	5.4	10.7	16.1	21.4	32
9	1.7	3.2	4.9	6.6	9.8	25	5.7	11.3	16.9	22.5	34
9.5	1.8	3.5	5.2	7.1	10.5	26	5.9	11.8	17.7	23.6	35
10	1.9	3.7	5.6	7.5	11.2	27	6.2	12.3	18.5	24.7	37
10.5	2.0	3.9	5.9	8.0	11.9	28	6.5	12.9	19.3	26	39
11	2.2	4.2	6.3	8.5	12.6	29	6.8	13.4	20.1	27	40
11.5	2.3	4.4	6.6	9.0	13.3	30	7.1	13.9	20.8	28	41
12	2.4	4.7	7.0	9.4	14.0	36	8.6	17.2	26	34	52

DESIGN EXAMPLE

Calculations for any section of the main duct are similar to those for a single branch duct, except that the TP existing at the upstream point is substituted for 2, 3, and 7 in determining the TP at the downstream end of the section.

Calculations involved in the design of a local exhaust system are best demonstrated by designing a system. In Fig. 31 is shown the layout of the system to be designed, including the data pertaining to hoods, bends, and collector. The contaminant to be exhausted is a light industrial dust which will require a minimum transporting velocity of 3500 fpm. The ductwork will be of good industrial design and construction.

An inspection of the layout reveals that hoods 1 and 7 are almost equally distant from the collector; however, number 1 is slightly farther removed and will be chosen as the starting point in the calculations. The calculations for several branches will be carried forth in the steps outlined earlier for duct design.

Branch A

1. Minimum transport velocity = 3500 fpm.
2. From Fig. 14, d = 7-in., V = 3750-in., and VP = 0.88.
3. Hood entrance loss = 0.26 VP (from Fig. 31 and Table 6)
4. From Table 8 the straight duct equivalent of bends *a* and *b* is 10.8 ft.
5. Total duct length is 62 (from Fig. 31) plus 10.8 = 72.8 ft. From Table 11,

$$RP = 2.80\ VP\left(\frac{75.8}{26} = 2.80\right)$$

TABLE 9.—FACTORS BY WHICH VALUES FROM TABLE 8 MUST BE MULTIPLIED FOR BENDS HAVING RADII OTHER THAN 2.5d

Ratio of Radius of Bend In. to Duct Diam. In.	Factor by Which Value from Table 8 Must be Multiplied
1	3.5
1¼	2.5
1½	1.8
1¾	1.4
2	1.2
2¼	1.1
2½	1.0
2¾	1.1
3	1.2

TABLE 10. — COEFFICIENT OF ROUGHNESS FOR DIFFERENT TYPES OF DUCTWORK
(To be used in Equations 15 and 16)

Type of Ductwork	Coefficient of Roughness
Excellent, smooth pipes	60
Average exhaust system of good design	55
Not-too-well designed system with rough ducts	40
Old, bent, and damaged ducts (also most flexible metal hose)	30

6. No losses of this nature.
7. From Fig. 31 and Table 13 the entrance loss at point *b* is 0.28VP.
8. The TP at point *c* is therefore 4.34 VP (1.0 + 0.26 + 2.80 + 0.28) which equals 3.82 inches of water.

Branch B

1. Design $V = 3500$ fpm.
2. From Fig. 14, $d = 6.5$-in., $V = 3500$, and VP = 0.76.
3. Hood entrance loss = 0.49 VP (from Fig. 31 and Table 6)
4. Straight duct equivalent of bend at *c* is 3.3 ft (from Table 8)
5. Total duct length = 25 + 3.3 = 28.3 ft. $RP = 1.18\ VP\left(\frac{28.3}{24} = 1.18\right)$
6. None.
7. From Fig. 31 and Table 13 the entrance loss at *c* is 0.28 VP.
8. TP at point *c* is 2.95 VP or 2.24 inches of water.

Obviously the resistance in Branch *B* is lower than in *A*, as would be expected since the length of the duct is much shorter.

Redesign Branch B

1. Same.
2. From Fig. 14, $d = 6$ in., $V = 4100$, and VP = 1.05.
3. Same.
4. Equivalent length from Fig. 31 and Table 8 is 3.0 ft.
5. Total duct length from Fig. 31 and 4 is 28 ft.

$$RP = 1.27\ VP\left(\frac{28}{22} = 1.27\right)$$

(From Table 11)

6. Same.
7. Same.
8. TP at point *c* is 3.04 VP or 3.20 inches water gage.

If the next size smaller duct were used the TP of Branch *B* would be much more than for Branch *A*, hence 6-in. is the proper size duct. Therefore, 3.04 VP in Branch *B* must equal 3.82-in. and VP = 1.26-in., $V = 4495$ from Table 3, and $Q = 890$ cfm from Fig. 14.

Section C

1. $V = 3500$ and $Q = 1890$.
2. $d = 9\frac{1}{2}$-in., $V = 3850$ and VP = 0.92 from Fig. 14.
3. None.
4. None.
5. 0.53 VP.
6. None.
7. None.
8. TP at point *d* Fig. 31 equals

$$4.15\ VP\left(\frac{3.82}{0.92} = 4.15\right)$$

from point *c* plus 0.53 VP = 4.68 VP or 4.31 inches water gage.

The previous calculations have been carried out step by step to show the method involved. It is apparent however that much paper and time would be consumed in the completion of the design example. These calculations can be speeded very much by employing a form as shown in Fig. 32 on which are given also the complete design calculations for the foregoing example.

To demonstrate a real short cut made possible by this form, let us reconsider Branch *B* which required a second set of calculations to obtain a balance. On the form shown in Fig. 32 the branch calculations which are recorded in columns 6, 7, and 10 are unaffected by changes in pipe sizes and may therefore be recorded permanently. Columns 4 and 5 should not be completed until the proper size duct has been determined and the values for columns 3 and 8 should be inserted only lightly since they are subject to change if the proper duct size has not been selected for the initial calculation. It should be noted, however, from the step by step calculations for Branch *B* that the RP for the ductwork is affected only very little by a change in duct size.

By using the form in Fig. 32 we find that the TP for Branch *B* using

TABLE 11.—LENGTH OF STRAIGHT DUCT WHICH HAS AN RP OF ONE VP

$L = 0.0365CdQ^{0.09}$

Duct Length in Feet for Resistance of One VP					Duct Length in Feet for Resistance of One VP				
Duct Diameter, Inches	Very Smooth Ducts	Average Duct Construction	Rough Ducts	Old, Bent, Damaged Ducts	Duct Diameter, Inches	Very Smooth Ducts	Average Duct Construction	Rough Ducts	Old, Bent, Damaged Ducts
3	11	9.7	7.1	5.3	13	60	55	40	30
3.5	13	12	8.4	6.3	14	65	60	43	32
4	15	14	9.9	7.4	15	70	65	47	35
4.5	17	16	11	8.5	16	76	70	51	38
5	19	18	13	9.7	17	82	75	55	41
5.5	22	20	14	11	18	88	81	59	44
6	24	22	16	12	19	94	86	63	47
6.5	26	24	18	13	20	100	92	67	50
7	29	26	19	14	21	106	97	71	53
7.5	31	29	21	16	22	112	104	74	56
8	34	31	22	17	23	117	107	78	59
8.5	36	33	24	18	24	123	113	82	62
9	39	35	26	19	25	129	118	86	65
9.5	41	38	27	21	26	135	124	90	68
10	44	40	29	22	27	141	129	94	71
10.5	46	42	31	23	28	147	135	98	74
11	49	45	33	24	29	153	141	102	77
11.5	52	47	34	26	30	160	146	106	80
12	55	50	36	27	36	200	184	133	100

TABLE 12.—ENERGY LOSS IN DUCT ENLARGEMENTS AND CONTRACTIONS

Included Angle (*s*) Degrees (See Fig. 28)	Ratio $\frac{L}{D-d}$ (See Fig. 28)	Loss in % of Velocity Head Change (H_v in Smaller Duct Minus H_v in Larger Duct)	
		Enlargements	Contractions
5	11.4	3	Negligible
10	5.7	12	6
20	2.7	37	18
30	1.7	57	28
40	1.2	73	36
50	0.85	88	44
60 or more	0.60 or less	100	50

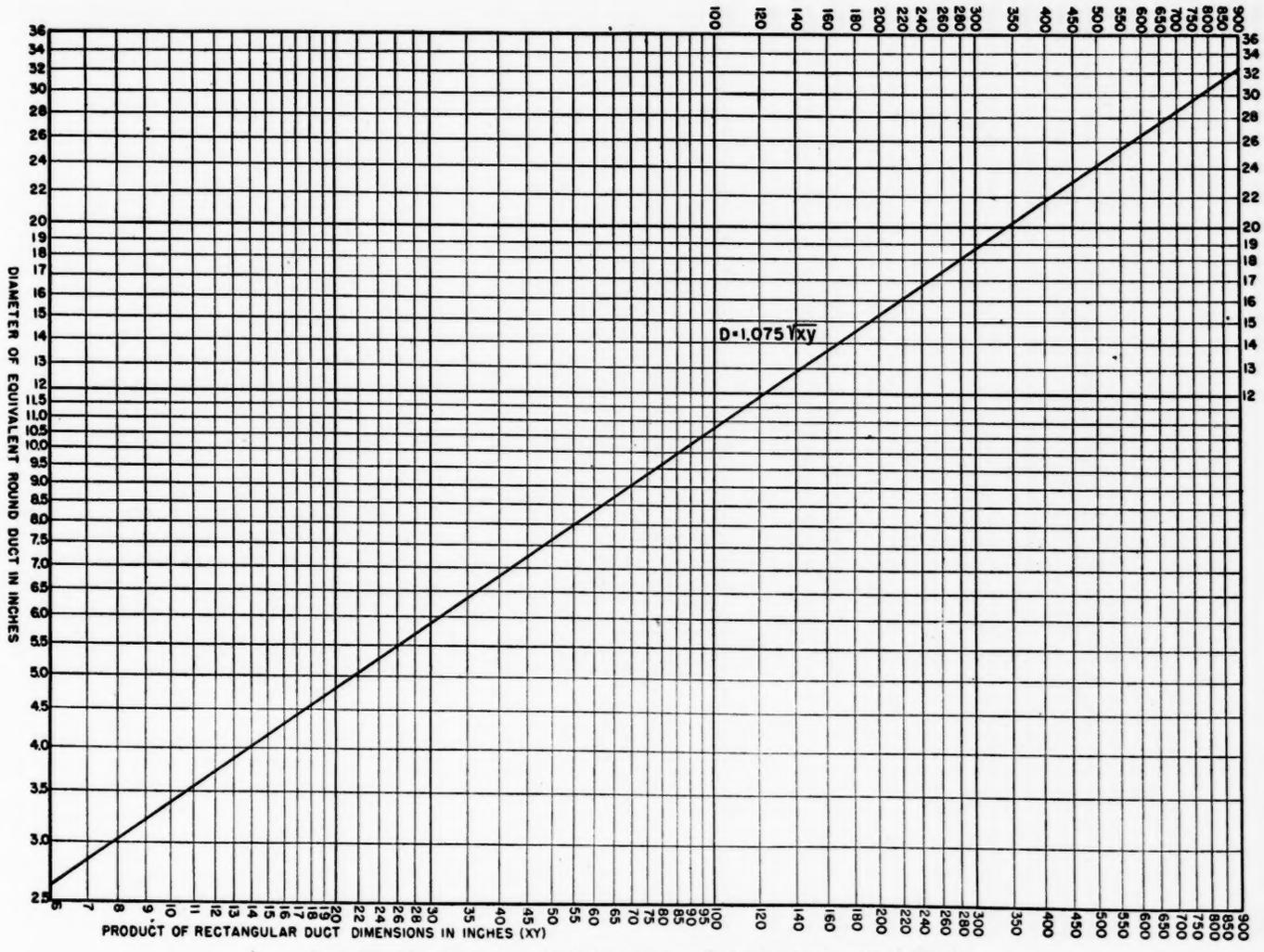


Fig. 29. Rectangular duct in terms of equivalent round duct.

a 6.5-in. duct is 2.95 VP (1.0 + 0.49 + 1.18 + 0.28). Since the TP at point *c* is 3.82, the VP for Branch *B* must be $\frac{3.82}{2.95} = 1.29$-in. Hence *V* is approximately 4550 fpm from Table 3 and since the TP for Branch *B* should not exceed 3.82, Fig. 14 indicates that a 6" diameter duct is needed. Columns 3, 4, 5, 8 and 9 can now be completed from which it is found that 3.04 VP = 3.82. Hence VP = 1.26, *V* = 4500 fpm and *Q* = 890 cfm.

Branches *D* and *F*, and sections *F* and *G* are designed in similar fashion and the results are recorded in Fig. 32.

The other half of the duct system requires special consideration otherwise a balance might not be obtained at point *g*, requiring a series of trial calculations. The determining resistance is obviously that caused by Branch *L* and sections *J* and *H*, since Branches *I* and *K* will be calculated to balance the TP at points *h* and *i*. Hence, by listing the branches and sections on the tabulating form and inserting the known values in columns 6, 7, and 10 (from Fig. 31), and the approximate values in columns 3 and 8, the TP at point *g* for Branch *L* and sections *H* and *J* is determined in terms of the VP. The value of VP may then be determined by dividing into the TP at point *g* for the other section, namely 4.92.

In the calculation of this example for instance, the TP at *g* was found to be 5.88 VP. Thus the design velocity is 3670. This value is quite close to the minimum transporting velocity only because the duct system is well balanced on both sides of the junction at *g*. If only one short duct were on the right side of the junction, the required *V* would be much higher. The final calculations are then carried out by starting with the most remote branch namely *L*.

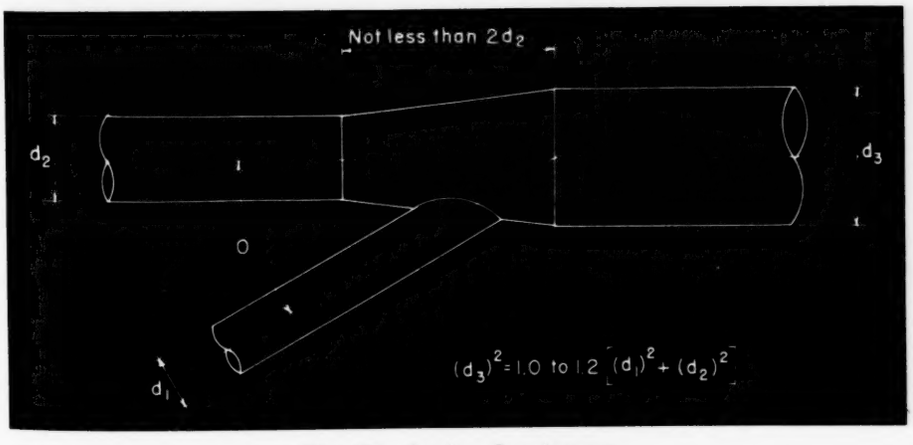


Fig. 30. Angle of entrance.

TABLE 13. — RESISTANCE PRESSURE AT ENTRANCE TO MAIN DUCT IN TERMS OF VELOCITY PRESSURE IN BRANCH

Angle in Degrees at Which Branch Duct Enters Main (See Fig. 30)	Entrance Loss (RP) in % of VP in the Branch
10	6
15	9
20	12
25	15
30	18
35	21
40	25
45	28
50	32
60	45

Another point of interest in the design of the second half of the duct system arose in the calculations pertaining to Branch *L*. If a 6-in. duct had been selected to obtain a transporting velocity above 3500 fpm, the TP at point *i* would have been very high since at 800 cfm, *V* would be about 4100 fpm. This high TP at point *i* would then be carried through to point *g* since little reduction in TP over that estimated for sections *H* and *J* can be effected owing to the low design velocity as compared to the lower limit of the transporting velocity. The solution lay in increasing *Q* in Branch *L* slightly to obtain a duct velocity above the minimum transporting velocity. A velocity of 3600 fpm was selected since (a) it was close to the calculated required velocity of 3670 fpm, (b) it was above the minimum transporting velocity, and (c) it required only a small increase of *Q*.

This should be remembered in the design of the first two branches of any system. If the design value of *Q* is adhered to strictly for the design of the most remote branch, a high

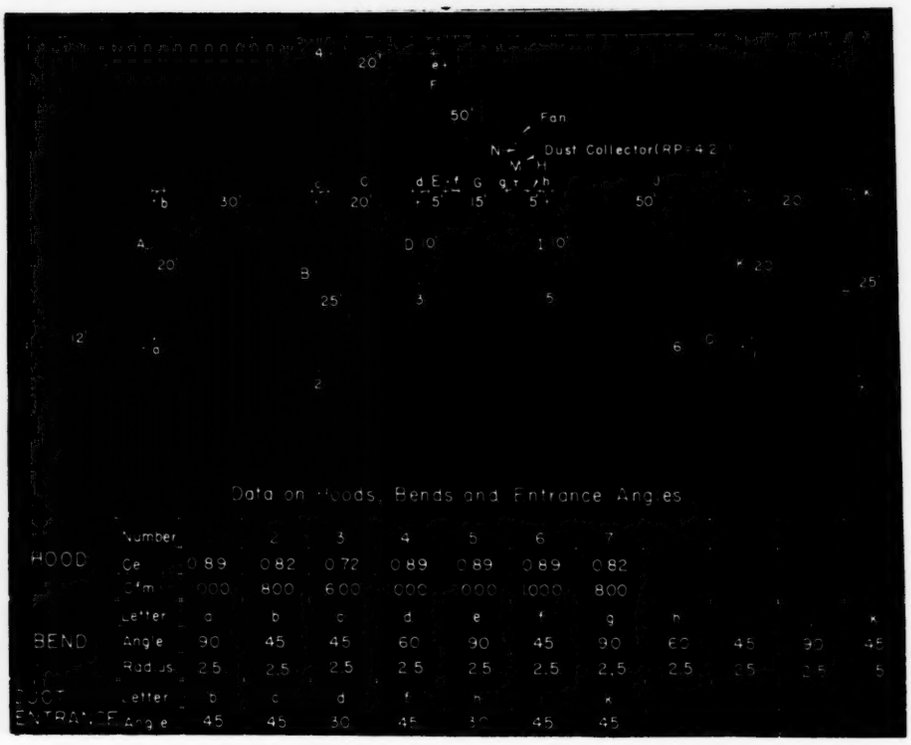


Fig. 31.

Branch or Section	"Q" in cfm	"d" in inches	"V" in fpm	VP in inches	Pressure loss in terms of VP						TP in inches of water	Junction designation	Final			
					Initial or VP	Hood entrance	Ducts and bends	Collectors, traps, etc.	Duct junction	TP at junction			VP in inches	"V" in fpm	"Q" in fpm	TP in inches
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
A	1000	7	3750	0.88	1.0	0.26	2.80	0	0.28	4.34	3.32	c	0.88	3750	1000	3.32
B	800	6	4100	1.05	1.0	0.49	1.27	0	0.28	3.04	3.20	c	1.26	4500	890	3.32
C	1890	9½	3850	0.92	4.15	0	0.53	0	0	4.68	4.31	d	0.92	3850	1890	4.31
D	600	5	4400	1.21	1.0	0.93	0.73	0	0.18	2.84	3.44	d	1.52	4950	675	4.31
E	2565	11½	3550	0.78	5.53	0	0.11	0	0	5.64	4.40	f	0.78	3550	2565	4.40
F	1000	7	3750	0.88	1.0	0.26	3.10	0	0.28	4.64	4.08	f	0.95	3900	1040	4.40
G	3605	13	3900	0.95	4.63	0	0.55	0	0	5.18	4.92	g	0.95	3900	3605	4.92
L	800	6½	3475	0.75	1.0	0.49	2.12	0	0.28	3.89	2.92	i	0.71	3600	830	3.15
K	1000	7	3750	0.88	1.0	0.26	1.57	0	0.28	3.11	2.74	i	1.01	4025	1075	3.15
J	1905	9½	3875	0.94	3.35	0	1.31	0	0	4.66	4.38	h	0.94	3875	1905	4.38
I	1000	5½	6050	2.28	1.0	0.26	0.68	0	0.18	2.12	4.84	h	2.06	5750	950	4.38
H	2855	11	4325	1.17	3.74	0	0.39	0	0	4.13	4.84	g	1.19	4375	2880	4.92
M	6460										4.20					9.12
N	6460	18	3650	0.83	11.0	0	0.06	0	0	11.06	9.2		0.83	3650	6460	9.2

Fig. 32.

V may result and the TP at the point of junction would be needlessly high resulting in a greater power consumption than necessary. If *Q* is increased slightly so that the next larger standard duct can be used and *V* is kept at a value only slightly above the minimum transporting velocity, the TP at the intersection will be much lower, resulting in a more efficient design.

The exhauster must be chosen on the basis of the volume of air flow and final TP shown in Fig. 32. The discharge duct or stack from the fan was not included in this calculation. Its RP should be added to the TP shown in the table to obtain the value to be used for fan selection. Owing to leakage and reduction in efficiency as the system becomes worn, it is advisable to increase *Q* as calculated by about 20 to 25% to insure satisfactory performance after considerable use. Consequently, a fan would be selected to handle 8100 cfm at a total pressure of 9.2 inches of water (plus that for a suitable discharge stack). The brake horsepower BHP of the fan motor would be calculated by the following equation:

$$BHP = \frac{Q \times TP}{6356 \times ME} \quad (18)$$

Where BHP = brake horsepower of fan motor
Q = quantity of air in cfm (8100 for this example)
TP = total pressure in inches of water of duct system including the discharge stack
ME = the mechanical efficiency of the fan which can be obtained from the manufacturer.

Even though the design of a local exhaust system includes the selection of a suitable fan and may include the selection of a collector, the characteristics of these devices will not be discussed in this paper.

The Welding of Process Piping

ARTHUR N. KUGLER

Mechanical Engineer, Air Reduction Sales Co., New York, N. Y.

PART 4

THE nickel and nickel alloy classification as covered by box 4-4 (Fig. 1) is a large group which must be arbitrarily limited in terms of piping material — only the more common analyses are covered. Therefore, this discussion will be limited to nickel, monel and inconel. For a more complete discussion of the many alloys reference is made to the Welding Handbook.[12]

While metal arc welding is listed as the preferred joining process, actually either this procedure or oxyacetylene welding may be used with equal success, other factors generally controlling the choice. Low temperature brazing with the silver-copper-cadmium-zinc alloy also finds extensive application. Brazing alloys containing phosphorus should be avoided due to the unfavorable reaction between this element and these alloys. Braze welding with the copper-zinc rods while possible is hardly suitable under the conditions of corrosion to which these metals are subjected. However, if corrosion is not a factor then this technique may be employed.

Welds in all Positions Possible

In general on these alloys, joint designs suitable for welded steel piping may be employed. Welding may be accomplished in all positions with either metal arc or oxyacetylene welding. Beveling of pipe ends must be performed with machine tools—not oxyacetylene or carbon arc cutting. The reason for this is that the quality of the latter cuts is poor and cut surfaces are severely oxidized.

Metal arc welding of pure nickel is done with a nickel shielded arc electrode used on reverse polarity (electrode positive). Surfaces to be welded must be clean and free of oxides. Welding in all positions progresses with about the same ease as on steel. Preheating is neither necessary nor recommended. Stress relieving need not be employed unless specifically required by codes. The high ductility of nickel base and weld metal is sufficient to care for most stresses encountered in welding thicknesses found in pipe. Welding with alternating current is not possible with nickel.

Oxyacetylene welding of nickel proceeds in much the same manner using a nickel steel welding rod. No flux is necessary. A flame burning with a slight excess of acetylene (slightly reducing) is recommended.

Brazing with the silver-copper-cadmium-zinc alloy on the lap or shear type joint may also be employed on pure nickel. Cleaning to remove the dark oxide may be accomplished by mechanical or chemical means.

For monel metal arc welding, a monel metal shielded electrode is recommended. This same electrode may be used for combinations of monel and steel, and nickel and steel. Surfaces to be welded should be thoroughly cleaned. Preheating is not recommended. Stress relieving is not necessary unless called for by some code requirement.

For oxyacetylene welding of monel a welding rod of the same composition should be used. The welding flame should be adjusted to a slightly reducing condition. A flux specifically designed for welding monel should be applied to the top and bottom of both pieces as well as the edges (either straight or beveled). The flux is prepared in thin paste form from the powder by mixing with alcohol or dissolving in boiling water. Flux residue may be removed with warm water.

Monel is successfully brazed with the silver-copper-cadmium-zinc alloy applied on lap or shear type joints.

Inconel is metal arc welded with shielded arc electrodes of the same analysis using reverse polarity. While this metal may be welded in all positions, it is recommended that where possible the work be arranged to permit welding in the flat position.

Oxyacetylene welding of inconel is accomplished with welding rods of the same analysis; a slightly reducing flame is recommended. Flux especially designed for this work is necessary. Flux, mixed to a thin paste by dissolving slowly in orange shellac-alcohol (1:5) solution, is painted on the joint—top, bottom and edges. Inasmuch as this flux contains fluorides, good ventilation in the vicinity of the welding operation is necessary.

As with the other high nickel alloys, inconel may be silver brazed with the silver-copper-cadmium-zinc alloy, employing the lap or shear type joint.

Box 4-5 involves joining nickel-bearing metals with aluminum. Such joining is impractical insofar as present knowledge is concerned. Reasons given previously also apply in this instance.

Welds to Cast Iron

There is but little choice in the methods suggested in box 4-6 for connections of nickel base metals with cast iron. Brazing with the silver-copper-cadmium-zinc alloy is preferred since this alloy shows somewhat better corrosion resistance particularly if the lap joint is designed to be remote from contact with the corrosive medium. Braze welding with any of the brass rods enumerated previously may be employed if service conditions permit.

The next major grouping, box 5-5, covers aluminum

[12]Welding Handbook, 1942—American Welding Society, pp. 910-943.

and its alloys. This again represents a vast number of compositions. However, for the present purpose one other factor, in addition to the limitation of piping material, assists in simplifying the problem. This factor is that of weldability of the various alloys.

Before engaging in a discussion of the welding of aluminum, it is appropriate to examine the method of designating the various analyses and conditions of heat treatment. The system in most common use has been developed by the Aluminum Company of America[13] and employs numbers and letters to identify the alloy and condition. Each of the several analyses is identified by a number and this number is reserved for that analysis whether it is employed in wrought or cast form. For wrought metal such as is used in pipe, the letter *S* following the number is the designation. When the metal is cold worked to produce the final form it becomes hardened, the amount depending upon the reduction. If this hardened metal is annealed it becomes soft. Therefore, when wrought metal is fully annealed the condition is indicated by the letter *O* following the *S*. If metal is left in a hardened condition after cold working this is shown by designations such as *1/4H, 1/2H* or *H* in place of the *O; H* indicates the maximum hardness attainable by cold work.

For those compositions susceptible to heat treatment other letters are used to identify the condition of the alloy. Heat treatment of aluminum alloys is an involved subject and not one of particular interest here. However, letters *R, W* and *T* following the *S* indicate the alloy has been afforded some form of thermal or other treatment to increase the mechanical properties.

These facts are of particular importance when considering the welding of such metals. Obviously those alloys which have been heat treated cannot be welded without destroying the effects of heat treatment. The strength of such a welded assembly would be uncertain. The one method of overcoming this difficulty is to heat treat after welding but this is hardly a practical operation for piping welded in place. Therefore, for welded aluminum piping it is safest to employ analyses that are not subject to heat treatment.

Aluminum Alloys

Of the vast group of aluminum alloys, those bearing the numbers 2S* and 3S* (see Table 1 for analyses) are the most readily welded. Alloy number 52S is somewhat more difficult to weld but is considered weldable. Since most of this difficulty is encountered in lap or fillet welds, and since butt welds are more common for piping, it need not be considered as ruling out this analysis. Of the heat treatable compositions, 53S and 61S are classified as weldable, although it must be remembered there will be a loss in mechanical properties. Of this group of alloys, only 2S, 52S and 61S are listed as being currently available as pipe or tubing alloys.

[13]Aluminum and Its Alloys—Aluminum Company of America—1944.

*These numbers assigned to compositions by Aluminum Company of America.

In the tabulation of welding processes, oxyacetylene welding is listed first for the reason that it may be used for welding in all positions. Metal arc welding produces equally satisfactory results but control of the arc on thin sections is difficult and welding in the vertical and overhead positions is not as easily accomplished as with the gas process. Gas shielded arc welding is here included, for preliminary work indicates that the procedure offers possibilities. However, no actual piping installations have been welded with this technique. Aluminum brazing has proven particularly successful in war production on items of a construction similar to piping, hence should find applications in post-war work. Carbon arc welding is listed last since it is limited to welding in the flat position.

Joint designs commonly employed in welding other metals are used on aluminum with one slight modification. On sections 1/16 in. thick and heavier, it is suggested that the edges of square groove butt joints be notched with a chisel to an approximate depth of 1/16 in. and the notches be spaced 3/16 in. apart.

For the oxyacetylene welding of aluminum of 2S or 3S analyses, a welding rod of the 2S composition is generally recommended. However, a 43S analysis welding rod may also be employed. For welding the other weldable analyses, the 43S type welding rod is employed. A flux specifically designed for welding aluminum is necessary to dissolve the ever-present oxide film and permit molten metal to flow together. The flux should be mixed with water to form a paste which is brushed on the top and bottom surfaces of the joint as well as the edges. Flux paste must also be applied to the welding rod. After welding, the spent flux should be removed with hot water. Since aluminum fluxes contain fluorides, adequate ventilation of the welding operation is necessary to remove flux fumes. A greater number of tack welds are needed on aluminum than on steel, to preserve alignment. Tack welds should be spaced 1-2 in. apart on light (1/16 in. and less) material. This spacing may be extended to greater distances on heavier material.

Metal arc welding of aluminum and its alloys should be accomplished with heavy coated, shielded arc electrodes made on core wire of 43S analysis used with reverse polarity. Just as flux is necessary in oxyacetylene welding, so is the flux coating of the electrodes necessary in metal arc welding. However, the coating also assists in arc stabilization. General

TABLE 1.—NOMINAL COMPOSITION OF WELDABLE ALUMINUM ALLOYS

Alloy No.	Copper	Silicon	Manganese	Magnesium	Chromium	Aluminum
2S						99 min.
3S			1.2			Bal.
43S		5.0				Bal.
52S				2.5	0.25	Bal.
53S		0.7		1.3	0.25	Bal.
61S	0.25	0.6		1.0	0.25	Bal.

experience seems to indicate that arc welding is most successful on thicknesses above 1/8 in. In welding from one side only, as is necessary on pipe joints, a backing structure of metal other than aluminum is desirable. This backing metal should have a semi-elliptical groove about 1/16 in. deep and wide enough to span the weld, to permit of fluxing the under side of the root and to accommodate the penetration.

Welding in the vertical and overhead positions is difficult and requires a short arc. Stringer beads are favored for this work although weaving is sometimes employed on vertical welding.

Gas shielded arc welding is included for its potentialities since there is no record of its use on piping. It is currently applied, using the tungsten arc in helium, to weld aluminum tanks automatically. It has also been used to weld light (1/4 in.) structural shapes for electrical equipment. This latter work was in all positions. The same filler rods used in oxyacetylene welding are employed. Flux used consists of a 50-50 mixture of aluminum welding flux and aluminum brazing flux in alcohol.

Aluminum brazing, in principle at least, is similar to silver alloy brazing but uses different alloys and fluxes. While the lap or shear type joint characteristic of other brazing techniques is strongly recommended, it is sometimes possible in aluminum brazing to use in addition the simple tee joint. Special aluminum brazing alloys and fluxes are available. The success of the operation depends on the fact that these alloys are designed to melt below the melting point of the base metal and in the presence of the molten flux flow readily into the joints and adhere to the part. Since silver brazing on socket

When joining this → to this ↓	STEEL, WROUGHT IRON, AND GALV. IRON	COPPER AND COPPER BASE ALLOYS	STAINLESS STEELS	NICKEL AND NICKEL ALLOYS	ALUMINUM AND ALUMINUM ALLOYS	CAST IRON
STEEL, WROUGHT IRON, AND GALV. IRON	Metal arc welding Oxyacetylene welding Braze welding Brazing 1-1					
COPPER AND COPPER BASE ALLOYS	Braze welding Brazing Metal arc welding 1-2	Oxyacetylene welding Braze welding Brazing Carbon arc welding Metal arc welding 2-2				
STAINLESS STEELS	Metal arc welding Oxyacetylene welding Brazing Braze welding 1-3	Brazing Braze welding 2-3	Metal arc welding Oxyacetylene welding Brazing Gas shielded arc welding Braze welding 3-3			
NICKEL AND NICKEL ALLOYS	Brazing Metal arc welding Oxyacetylene welding Braze welding 1-4	Brazing Braze welding 2-4	Metal arc welding Oxyacetylene welding Brazing Braze welding 3-4	Metal arc welding Oxyacetylene welding Brazing Carbon arc welding Gas shielded arc welding Braze welding 4-4		
ALUMINUM AND ALUMINUM ALLOYS	Not a practical welding or brazing operation at the present time 1-5	Not a practical welding or brazing operation at the present time 2-5	Not a practical welding or brazing operation at the present time 3-5	Not a practical welding or brazing operation at the present time 4-5	Oxyacetylene welding Metal arc welding Gas shielded arc welding Brazing Carbon arc welding 5-5	
CAST IRON	Braze welding Brazing Metal arc welding 1-6	Braze welding Brazing 2-6	Brazing Braze welding 3-6	Brazing Braze welding 4-6	Not a practical welding or brazing operation at the present time 5-6	Oxyacetylene welding Metal arc welding Braze welding Brazing 6-6

Fig. 1. How to join one metal with another. Shaded part indicates the methods discussed in this article.

type fittings has been eminently successful, it is reasonable to expect that aluminum brazing on similar fittings of aluminum, when available, will be equally successful.

Carbon arc welding is included here since it is used for welding aluminum. However, it finds its greatest application in the welding of heavy-walled tanks and pressure vessels. Filler rods and fluxes are substantially as outlined for oxyacetylene welding. It is hardly suitable for pipe welding since it is limited to operations in the flat position. It might prove advantageous in shop welding only.

The dissimilar metals covered by box 5-6, namely aluminum to cast iron, must be considered for the present as being impossible of joining by either the welding or brazing process.

Cast Iron Group

Cast iron, box 6-6, is the last metal covered by the grouping of Fig. 1. The ability of cast iron pipes to withstand corrosion is largely attributable to the "skin" which forms during casting. However, if this skin is broken, the casting will corrode about as rapidly as other ferrous materials.

Several years ago an extensive survey of metal pipes for underground service was conducted. Pipes of various metals were buried in different soils in many parts of the country. In the report on this work a significant comment was included to the effect that the products of corrosion of cast iron pipe appeared to possess greater strength, as a pipe, than the corrosion products of other ferrous metals employed in the tests. In consequence of this, cast iron gives good results for many underground systems.

Among the more distinguishing features of common gray cast iron are its high carbon and silicon contents — carbon 2.50-3.70%, silicon 0.50-3.00%. Further it possesses very low tensile strength and almost negligible ductility. While the actual welding of cast iron is not very difficult, these factors contribute to make the overall operation a difficult one requiring care in the application of heat.

In addition to gray cast iron, there are also obtainable several alloy cast irons which are available in pipe form. The more important of these are chrome-nickel cast pipe and the high nickel, austenitic cast iron pipe. Both of these alloys exhibit materially higher tensile strength and a moderate degree (compared to steel) of ductility when compared to gray cast iron.

The oxyacetylene process is indicated as the preferred method of welding since, if used with the correct procedure, it will produce the best and most reliable results. Furthermore, this process may be used for welding in all positions. Metal arc welding is included second for the reason that shielded arc electrodes with cast iron cores are available, and while limited to work in the flat position, will produce weld deposits of cast iron. Braze welding is listed third notwithstanding its wide use on cast iron, simply because it introduces a dissimilar metal which might be objectionable in process piping. Brazing with the silver-copper-cadmium-zinc alloys is not used to any extent but offers possibilities in those instances where it is desired to avoid high temperatures.

For the welding of gray cast iron it is recommended that the oxyacetylene flame be adjusted to a slightly reducing condition. In addition the welding rod should be of the following analysis:

Carbon	3.00 — 3.75
Manganese	0.40 — 0.80
Phosphorus	0.75 max.
Sulfur	0.10 max.
Silicon	2.75 — 3.50

A cast iron welding flux is also necessary to dissolve the oxides and float them to the surface. Preheating to a temperature of 1000F is essential to avoid cracking and to slow down cooling, thus yielding a soft weld. Preheating should be done at the ends of the pipes, extending back several inches, to avoid cracking. This is the greatest objection to the use of this method since it is difficult to perform this preheating on piping installed in place. Further, a problem is created if the pipes are fastened rigidly in place. However, if this procedure is followed the weld will be as good and in all probability superior to the casting. It is appropriate to point out here that in cast iron welding we have one of the few instances where the weld is an exact duplication of the base metal, physically, mechanically, and chemically.

The application of preheat to cast iron requires experience and a large measure of common sense to assure satisfactory results. It is difficult to give any general rules since each job must be studied individually and complicated castings require careful analysis. Perhaps the best guide for those who have not acquired this experience was provided by a highly skilled operator[14], in answer to a query on the subject from one who was daily confronted with the problem. The suggestion was simply that the operator consider that he was driving an imaginary wedge into the casting at the area where welding was to be performed. Examine the structure under this hypothetical condition and determine the point or points at which the stresses would be greatest or at which a fracture might occur. Then apply preheating at those points. This method will be found particularly helpful on complicated assemblies no matter what the method of welding.

For metal arc welding the shielded arc electrode manufactured on a cast iron core is recommended over the mild steel shielded arc electrode for cast iron. The former, while usable in the flat position only, deposits cast iron weld metal. The parts must be preheated to at least 300F, and higher temperatures will prove helpful. The mild steel electrode will prove acceptable for attachment for parts or for welding broken castings on which preheating would prove detrimental. The principal trouble with this electrode for piping is that it is very difficult to secure a tight weld; the weld, however, will be strong enough for cast iron.

[14]Forgett, V., an unpublished lecture given in Cleveland, 1938, before a group of marine inspectors on the topic "Welding as Applied to Maintenance."

For those conditions of service where the introduction of a dissimilar weld metal is not objectionable, there are available electrodes of a copper-nickel alloy analysis. These may be used without preheating although supplementary heating will facilitate welding and avoid cracking.

Braze welding is extensively used for the joining of cast iron parts for the reason that it may frequently be done without preheating, or with a minimum of preheating. In addition, the temperature for braze welding is several hundred degrees lower than that for welding. However, it must be recognized that the presence of brass with the cast iron may lead to difficulties with electrolysis. Cases of such action are on record. Nevertheless the inherent advantages of this process require its inclusion in this discussion. For filler metal on braze welded joints any of the rods represented by Analyses I, III or IV may be used.

A suitable braze welding flux is essential, or flux coated rods of the recommended analyses may be employed. Sometimes difficulty will be encountered in getting the molten brass to tin or flow on the cast iron surfaces. This is usually due to the presence of free graphite on the surface. To overcome this condition, it is recommended that a separate bonding flux be applied to the surface to be welded, either as a paste or in dry form. This flux will react with the surface condition, permitting the molten brass to flow on readily. Preheating is applied locally only, unless the assembly is such as to require general preheating to avoid cracking.

Silver alloy brazing of cast iron pipe joints is not commonly employed. However, for the attachment of small fittings, as for instruments, it offers the advantages of low temperature operations. The silver-copper-cadmium-zinc alloy, together with a suitable flux, should be used on the lap type joint.

The alloy cast irons previously referred to are welded with the oxyacetylene process, for welding rods of the same analyses are available. Metal arc electrodes for these metals have never been manufactured. Obviously the welding rod should match the analysis of the base metal, although in the case of chrome nickel cast pipe, standard cast iron rods have been used with good success. The actual welding operation proceeds in much the same manner as with ordinary gray cast iron. A standard cast iron welding flux is essential. Preheating is also employed but to a lesser extent—only the ends of the pipe for several inches being preheated.

In closing this section on cast iron it seems appropriate to point out that foundries make extensive use of carbon arc welding for the repair of minor defects. The procedure is very much the same as oxyacetylene welding, i.e., the same welding rods, fluxes and application of preheat. Its use on the installation of cast iron piping seems rather remote except, possibly, for shop fabrication.

The phenomenal results that may be obtained through the proper application of welding, as well as the effects of misapplication, have been amply demonstrated in war production. Many of these pipe metals have been used extensively for welded constructions in the war period. It therefore seems logical to reason that in the future even greater use of these materials will be made for welded process piping systems. However, such use must be made with full recognition of the limitations as well as the advantages if costly and wasteful errors are to be avoided.

This review of the welding of process piping is offered with the sincere hope that it may enable those engaged in this type of work to avoid these errors and thus to obtain the maximum benefits of welded piping—the closest approach to the ideal, jointless piping.

(End of this series)

Handling Coal at Ford Motor Company Rouge Plant

Three men, aided by gravity and modern machinery, unload 6,500 tons of coal daily at the Rouge plant of the Ford Motor Company. Approximately 2,000 tons are used in the steam generating plant, largest industrial unit in the world, while the balance goes to the coke ovens. It takes an average of 2½ minutes to unload a car.

Each morning a locomotive hauls a string of cars to a siding to await unloading. From that point until the empties roll to a stop on another siding, a series of operations is performed by only three men.

A pocket-size electric locomotive takes over where its big brother leaves off. One at a time it pushes cars to the bottom of a steep incline or hill. An automatic electric pusher, called a "Barney," finishes the job by pushing the loaded car to the crest of the incline that is 11½ feet above ground track level.

A man places chocks under the wheels while another drops steel clamps around the loaded car. A 400 hp electric motor turns the cradle and loaded car upside down, permitting the coal to fall into the belt-driven hoppers below. These carry coal to the breaker bins.

Emptied cars are dispatched automatically. As soon as one car is emptied the Barney has another in position. Then, as chocks are removed, the empty car is nudged on its way by a loaded car. The empty coasts down a steep incline, loses speed against a 22-ft roller coaster barrier, abruptly reverses directions, trips an automatic switch and coasts a quarter-mile to a siding reserved for empty cars.

The automatic car unloader is used only during the winter months, when company coal-carrying vessels are ice-bound. During the navigable seasons, coal is loaded directly from coal piles to coal conveyor lines.

All for Want of a PRV

T. W. REYNOLDS

WE know that a pressure reducing valve is desirable where the water pressure is excessive. We may also know that such a valve is advisable to reduce faucet leakage and maintenance. But we may not know how many complications are possible, or how serious and long drawn out these troubles can become if a pressure-reducing valve is not installed. All this was brought home some 11 years back, come April Fools Day, when the writer built his own residence.

We were then in the valley of the great depression, at a time when a combination steamfitter and plumber who contracted both trades had no money for materials—simply no money at all, period. This contractor was content to furnish labor only and for a lump sum. Therefore, since he had no interest in too much labor, he talked, argued, and broke down the writer's stand for a reducing valve and sundry other items. The writer was called "fussy", although the things that were not done as he wished have been headaches ever since. Incidentally, the work of all other building trades, of which the writer knew less, has never been troublesome.

Now for the harrowing details. Records show that faucets inside the house in time leaked and their washers were often renewed. Outside of the house, garden hose had a shortened life. However, the pressure was quite useful outside for sluicing away earth and rocks so intermingled with the stump roots that an axe was useless for root removal.

Long, long before this, it was discovered that the last word in a thermostatic mixing valve, as installed in the beautiful, tiled shower enclosure with glass door, was not a good mixer. In fact, it did no mixing at all, but instead gave only water of the coldest kind. It was in the days when there were still service men around, so the valve manufacturer sent a service man, who then and there made repairs and replacements. For the few hours the man was around, trouble stopped. However, he started a new leak from the mixing valve and this soon diffused over the sand finish of the living room ceiling below.

Water pressure was so great that with a garden stream one could do hydraulic mining.

Promptly the next day the mixing valve went back to the cold water basis and the service man was recalled. It was then found that the water pressure was around 100 lbs in the hours of maximum usage and much above this at night when water hammer was more easily produced at faucets. Pressure was particularly high due to high pressure in the street main.

Mixing valve difficulty was caused by the high water pressure setting up unequal pressures between hot and cold water connections. The differential was great enough to damage the valve mechanism and to prevent it from operating properly. Though the valve was repaired again, it operated satisfactorily for only a few hours and soon went back to the 100% cold water delivery, regardless of whether the indicator was turned to hot or cold.

Time passed. The beautiful chrome flush type of mixing valve perfection remained inoperative. Faucets throughout the house were not neglected. They were often snapped on and off, and too abruptly. Then came the day when a kitchen sink faucet developed sufficient water hammer to blow out a defective plug in an unused outlet on top of the hot water tank. With tank, oil burner and associated items nicely tucked away in a cosy spot back of the boiler, the tank rained or poured water on the oil burner long enough to require a new transformer.

Valve Wheel Was Lost

Although the transformer was supposedly waterproof unless inundated, this one did not prove waterproof. However, it may have been subjected to the equivalent of a complete immersion, as the original contractor had left the main house shut-off valve without any means of quick operation. His theory was that the valve should be left so only a plumber could operate it, though the real truth was that he had lost the wheel. The valve was left so that in time not even a plumber could operate its bent stem with end worn round by the misuse of many wrenches.

Following the accident, a nipple and cap were substituted for the defective plug to provide an air chamber of small diameter and limited in height as the tank was set very close to the ceiling. Tank and connections were then recovered as the previous insulation was destroyed by water.

When the house was built this problem of air chambers was discussed and it was then suggested that the chambers could be extended horizontally when they could not be vertical. Any form of air chamber seems to become waterlogged and to lose its cushioning effect in a short time. This was noted

when draining and refilling the system in question. The more often it was refilled, the less water hammer developed.

Back again to the troubles. With a passage of some more time War No. 2 came along. Though oil poured on troublesome waters, of which there were then many, is said to be good, oil became generally scarce and particularly so for this house. All known fuel economies had been put in practice long before Hitler started feuding and acquiring more living space. Some statement as to possible fuel economies was carelessly made to the ration board, but they had an inflexible rule and used it for the usual oil cut. Consequently, in the interest of further fuel conservation, the fireplace was used more often and those in the house shivered. Finally, a separate cast iron pot stove for domestic hot water was installed for firing with coal, wood, or rags, in the non-heating season.

As a big help in a clouded situation, the pot stove promptly cracked. At the time it was assumed to be defective, so a more substantial one was installed. This is still in service, although it has been subjected to high water pressure for a short time only, being valved off during the heating season. After this, things went along fairly peaceably for a couple of years, except that a *low down* tank closet would not shut off after use during the night. However, following repair and subsequent thottling of the fixture shut-off to cut down the pressure, the trouble stopped.

Hot Water Tank Ruptured

This brings the story up to the date of a recent rupture of the hot water tank. This time there was no defective plug carelessly installed to blow out and act as a safety valve. The rupture was near the top and close to the hot water supply connection through which the shock from water hammer was transmitted back to the tank. The piping is brass and the tank copper (250 lb test), so with new copper tanks not available and the life of present new galvanized tanks questionable, it was fortunate that the rupture could be sealed at the factory and the tank re-used. When again erected, the tank was turned to bring the repair at the bottom, because hot water tanks let go more often at the top than at points where there is less heat and air.

The tank and connecting piping covering again had to be renewed. Insulation on a tank has no weep holes as in a retaining wall and therefore does not localize water to the point of leakage. Water is distributed without partiality the full length of the tank and the entire insulation cover destroyed. In addition to the covering, a lot of piping had to be removed to get the tank out from its cosy spot.

One end of the tank and a connecting pipe had been originally bricked up in a masonry wall as one support for the tank, a very handy arrangement for the plumber, who was always ingeniously finding ways for the mason or some other mechanic outside his field to do his work for him. The only other supports for the tank is a drip pipe from the steam header and a pair of the usual pipe hangers at the other end of the tank. Now this masonry, as necessarily knocked out for tank removal, piled up on the floor and pushed a small wire brush back into an underfloor drain pipe immediately below. Unfortunately, the brush was stiff and became tightly wedged just inside the pipe's end. To free it required chipping away a small bit of the floor.

The wire brush, for want of anything else close at hand, had been used as a convenient block for the pipe opening to prevent rats and mice from entering the cellar. Though the drain terminated with the open end beyond the house, and somewhat above the ground slope of adjacent woodland, the rodents walked on the outside of the pipe from the ground contact out to the end above ground, and then made an acrobatic half circle turn to enter the pipe.

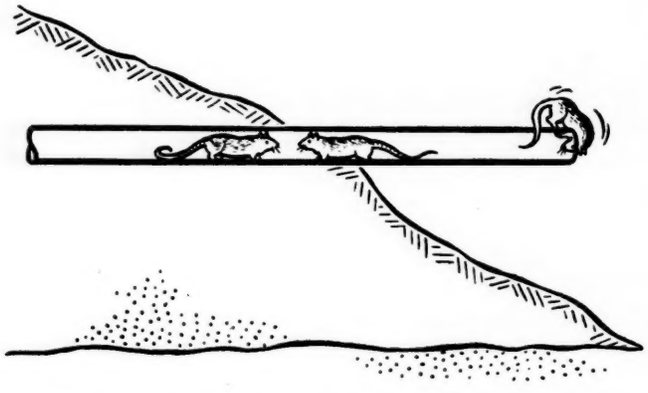
Now, according to codes, all oil pipes are supposed to be out of the way, as under the floor, to guard them from possible mechanical injury. One such oil pipe being out of sight in the floor was forgotten, so the chisel when backed up by a hammer, duly chipped away the floor over the drain and in time imparted the necessary mechanical injury to spout oil out in the chiseler's face. This continued briefly, while thoughts cleared enough to recall that since there were no water pipes under the floor and there could be no artesian wells, the chiseler must have struck oil. Prompt action was taken to shut off the flow. Had the oil pipes been out *in* sight, instead of out *of* sight, there would have been no mechanical injury.

The unfortunate accident was the writer's fault in attempting to clear up debris left by workers over a drain outlet which they had failed to cover properly. The accident happened about 9 o'clock on a cold Saturday evening at a time when such things always seem to occur. Notwithstanding the hour, an oil burner service man was finally located and arrived to find that the oil piping or tubing was not ⅜ in., but ½ in., an unusual size to replace, so he said. Therefore, lacking the necessary tubing and flared connectors of the proper size to replace the leaky pipe of unanticipated pipe size, he transferred the two-pipe gravity oil feed system into a one-pipe

"The chiseler must have struck oil. Prompt action was taken to shut-off the flow."

system by transposing the two pipes at the oil tank and by making a by-pass of smaller pipe size at the oil burner.

As a one-pipe system is more apt to air bind, the writer subsequently had the oil piping changed back to a two-pipe system. When the contractor arrived he said that the tubing was sized by its outside diameter, in this case 5/8 in., not 1/2 in., as he had been previously told over the phone. What was 1/2



"Rodents then made an acrobatic half circle to enter the pipe."

in. to the service man was 5/8 in. to him as a contractor. However, he rummaged around and soon located a lone coupling of 5/8 in. outside diameter in his car. This he sweated on at the point where the chisel cut had been made, and in place of the short damaged piece. He claimed this to be an even better method than if regular connectors were used, and it probably is.

While the contractor was on the job, a pressure reducing valve set at 50 lb pressure and a strainer were installed, with a by-pass and with a shut-off valve on the house side, and a wheel on the existing valve on the street side. A relief valve was placed at the tank set at 80 lb. The reducing valve immediately eliminated the loud metallic sound of water hammer with which we are all familiar. It substituted, however, a low raspberry sound of single note which was quite elusive, being anywhere else than near the opened faucet and usually not noticeable to the operator of such faucet. Not only was the new noise different in sound and intensity, but it was reversed from former operational sequence. Whereas the water hammer sound occurred as a faucet was suddenly closed, now it occurred only as a faucet was opened suddenly. Quickly closing a faucet could no longer produce the slightest noise, though the sudden opening and immediate quick closing of a faucet would sometimes cause a second note or follow-up echo.

As a further complication, though one of lesser magnitude, the relief valve at the tank relieved itself too frequently. The water so discharged was only a dribble, nevertheless it was hot water which could have been saved had the relief valve been installed on the cold water main.

It was apparent that pressure was being set up at the tank in excess of the 80 lb setting of the relief valve. It was obvious that any water expansion resulting from heating could no longer back up to the street because of the reducing valve in the main. It was also obvious that no overheating of the water, even after long continued burner operation following a night set-back on a cold night, could raise the temperature of the water to or above the temperature of the steam within the boiler—certainly not to where it would correspond to the 80 lb pressure setting of the relief valve. It did not seem probable that the water would expand to a point where relief would become necessary, even though there were not many air cushions in the system. It could be readily seen that sudden relief of expanded pressure, due to the quick opening of a faucet, could not cause flashing of steam (at the lower pressure from overheated water) and subsequent condensation of such steam. Water temperature, at the best, would be only that corresponding to 2 lb pressure and the pressure drop would not be to such a low point as to cause any flashing. If the last were the case, it would have occurred even more readily under the higher pressures formerly obtained before the reducing valve was installed.

Pressure Differential Increased

It was decided that the differential between the reducing valve and the relief valve settings should be increased by setting the reducing valve from 50 lb down to where there would still be sufficient pressure for second floor fixture usage. With the former setting of the reducing valve at 50 lb and the relief valve at 80 lb it was thought that it would be an easy matter to get a 30 lb build up from back pressure as a faucet is opened and closed. This, of course would kick the relief valve open frequently.

The operating differential was therefore decreased to the point where decrease in water flow would not be objectionable. However, in so far as could be observed, the relief valve no longer opened. On the other hand, the noise still continued about as before, though this was only for a day. During this day there appeared to be no change in either the noise or rate of water flow and this was regardless of whether the reducing valve was adjusted well upwards or downwards. The next day the noise disappeared entirely and for all time while the rate of water flow seemed to be much less. Checking the service main disclosed no leakage. The local water company said that there had been neither a change in their water pressure, nor had there been any recent breaks in nearby mains. Such breaks sometimes occur in the spring and become apparent as the ground thaws out. While it is now clear that one answer to this problem of noise was to reduce the pressure, it is still a bit confusing why the reduction in pressure did not immediately eliminate the noise.

As it is desirable for usage at fixtures to have the rate of water flow somewhat greater than that as recently reduced, it is proposed to install an air cushion or chamber to absorb the shock on the house side of the pressure reducing and relief valves, somewhat as illustrated. The vent valve shown in the sketch on the air chamber is for the purpose

of breaking any vacuum so that the chamber can be drained properly once it becomes waterlogged. The open vent valve will then recharge the chamber with air. As for the shut-off valve, this is necessary to avoid draining the entire system just to drain the air chamber. Will the installation as described permit higher water pressures, yet without noise?

Washers Had Short Life

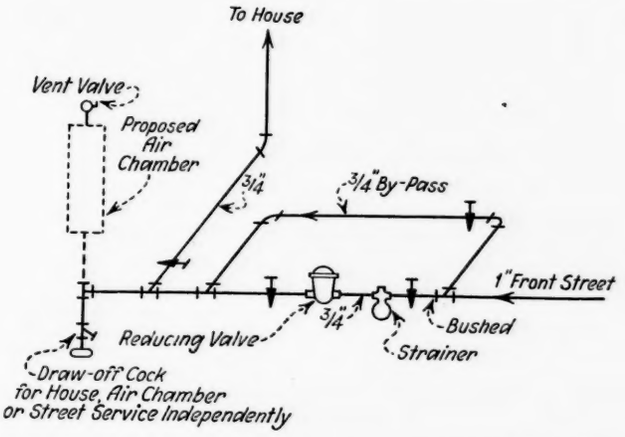
Faucet washers, it was suggested, become worn or grooved at the seat due to the need for closing faucets very tightly to keep them from dripping under the high pressure which formerly prevailed for several years. This would cause the piping to vibrate when faucets were opened slightly. However, there seems to be no chattering at the faucets and no noise of any kind if the faucets are slowly or normally operated.

Many other suggestions as to the cause and remedy of the troubles were made by various experts, no two of whom seemed to be in agreement. One said the reducing valve must have loose parts, another that it should have a seat whose size is one pipe size larger than the pipe to which it connects. Whether it has or has not the writer does not know, but he does know that on a steam reducing valve this method would give a low lift with consequent wire drawing and noise. Another expert says that the noise is due to the great velocity of water entering the system from the high side, but if this were the case the noise would occur at the reducing valve and any reduction of pressure on the low side would serve but to increase the noise. The flow at the reducing valve can be heard there, but it is not the noise in question. Incidentally, the valve may leak some pressure which builds up on the low side, particularly overnight, as the noise seemed greatest when fixtures were first used in the morning.

Scalding Made Easy

There would have been no need for a drain outlet in the floor to cause one of the troubles cited, if when the house was built, the contractor had not laid the return along the wall on the floor practically level, the easiest way. As so laid, it could not be drained, except by a draw-off valve located in a small open hole in the floor as an afterthought or way out of the situation. Here, again, the mason did most of the work for the plumber by breaking up the floor and extending a drain from a floor drain to a point at the boiler. Unfortunately, this draw-off cock was located in a hole too small for hose attachment; the cock could not be fully opened, since to do so filled the pit with hot water which was discharged by the boiler steam pressure faster than the drain could take the water. Neither could partial flushing out of the boiler water be done while the boiler was in operation without scalding one's hands in the pit water when closing the draw-off cock.

As a further example of how a contractor can leave a job due to thoughtlessness, carelessness, or perhaps without a full realization of what additional troubles these things can finally cause, the writer can mention the gasket on a flange union at the boiler steam supply outlet. This was blown out for it was found to be of the wrong size and material (rubber). The constant blowing of steam from this leak when pressure was raised was great enough to dangerously lower the boiler water line, especially



Reducing valve and air chamber arrangements to reduce water hammer.

so considering that there was a more than usual leakage at some of the radiator air valves. Until repaired, one had to remember that quite a bit of water must be admitted to the boiler each day. An interesting sidelight on this danger of low water was an occurrence which took place some time prior to the blowing of steam when one of the steel boiler tubes blew water through a minor leak. The leakage could not be located for some time as it took place only when the boiler tube was cold and contracted after a long lay off.

It may also be of interest to note how cold water came back to the emptied hot water tank after the tank and hot water piping had been drained for repairs to the system. At first such action began to border on the mysterious but the trouble was traced to the combination faucet at the kitchen sink. Each time this combination was opened, cold water was delivered through it from the cold to the hot water side. This side had been left open to break any vacuum, so that the hot water piping would drain while repairs were being made.

The job in general was made so good that it ran into trouble. Had the water main been of iron and of small size, there would have been less water pressure to cause water hammer. Had the drain been omitted, it could not have clogged up, and it would not have led to a punctured oil line. Had the oil tubing been of smaller size, the service man could have made immediate repairs with the stock materials he carried and continued the job as a two-pipe system. Finally, had the tank been set lower down without attempting to gain the last inch in thermal circulating head, there would have been room for a proper air chamber on top of the tank to take up any shock from water hammer.

What was good about the job in general worked out bad and what was bad in some cases worked out

(Continued on page 132)

New Developments in Washington

Retooling Considered as a Reconversion Step; Many Items to be Available as Surplus Material

LORING F. OVERMAN

"Within the last 10 days all hell's broken loose in this division, with all top-siders in refrigeration and air-conditioning up to their necks in reconversion plans.

"Ten days ago we would all have been shot for mentioning conversion," continued the speaker, an official of WPB's General Industrial Equipment Division. "Today, the same thing is likely to happen if we think about anything else."

An exaggerated statement, of course, but its very expansiveness tells what Washington really thinks about the outlook for the next few months. Quite obviously the conclusion is that industry is going to be called upon quickly to take up a big slack in a cut-back war production line.

First Step – Retooling

First actions within WPB sections devoted to heating, air-conditioning and refrigeration follow the pattern set by WPB Chairman J. A. Krug's announcement, on April 17, of conditions under which priorities assistance would be given those desiring to place immediate orders for machine tools needed to convert from wartime to civilian production.

Applications for such priorities assistance are already being acted upon favorably following submission by manufacturers of heating, air-conditioning and refrigeration equipment. The rapidity with which the industry responded, when the WPB Chairman let down the bars to real conversion planning, is doubtless responsible for the General Industrial Equipment Division's new beehive role.

Prior to the Krug statement of policy, machine tools for other than war production could be ordered only for delivery on a "when, if, and as basis," under the uninspiring terms of Priorities Regulation No. 24. Mighty few machine tools, if any, have been delivered under the terms of this regulation, particularly since last November, when the Battle of the Bulge caused a clamp-down on all civilian reconversion planning.

AA-3 Ratings Granted

In contrast, the new Krug-announced policy offers an AA-3 rating to assist in the purchase of "bottleneck" tools—loosely defined as those without which a plant might be either unable to reconvert at all, or be limited in its ability to produce and to employ labor.

"It is not possible at this time," said Mr. Krug, "to authorize the procurement by industries desiring to build new plants or set up entirely new production lines of all the tools and equipment needed for such lines. The country cannot yet undertake the impact of this kind of procurement. Instead it is our intent to grant ratings for fill-in or bottleneck tools and pieces of equipment without which a civilian production line would be unable to run."

To qualify for a rating, the applicant must show that:

(1) There is no reasonable prospect that the items can be acquired at the times requested without a rating. This condition will usually exist only in cases of items having a long manufacturing time so that unrated deliveries are difficult to schedule;

(2) The time requested for delivery is such that, if VE-Day were to occur immediately and applicable WPB restrictions on production were removed, the purchaser's resumption, initiation or expansion of production would be materially delayed by failure to receive the item on the specified date;

(3) The item is needed for production at the minimum economic rate.

(4) The items are only a small bottleneck portion of the total equipment needed for the civilian production, the remainder being on hand or available without special assistance;

(5) The items are actually needed to permit production, either in the purchaser's plant or an industry dependent upon him, and are not to replace or supplement existing equipment which is adequate through less efficient; and

(6) The product which the applicant will manufacture must generally be one that is needed for the civilian economy.

Today, instead of being "shushed" when they mention reconversion prospects, manufacturers of heating, air-conditioning and refrigeration equipment are being encouraged to survey their civilian production line needs, and to file immediate applications for ratings on bottleneck units that might stymie a rapid return to civilian output.

Auto Industry Points Way

Concrete evidence of what may be expected of the new policy is the granting of AA-3 ratings to the automobile industry for $50,000,000 worth of machine tools, and approval of a $35,000,000 construction program.

Construction projects proposed by other industries will also be judged by the six criteria listed above. Here again the WPB cautions that the interim policy cannot be used for other than construction work actually necessary to the resumption of civilian activities. The policy does not cover authorizations for new large scale plants such as some industries are planning.

The new policy takes on a doubly official look with the announcement that it has been cleared with the Central Requirements Committee of the War Production Board and has the concurrence of the Armed Services and other Claimant Agencies within WPB.

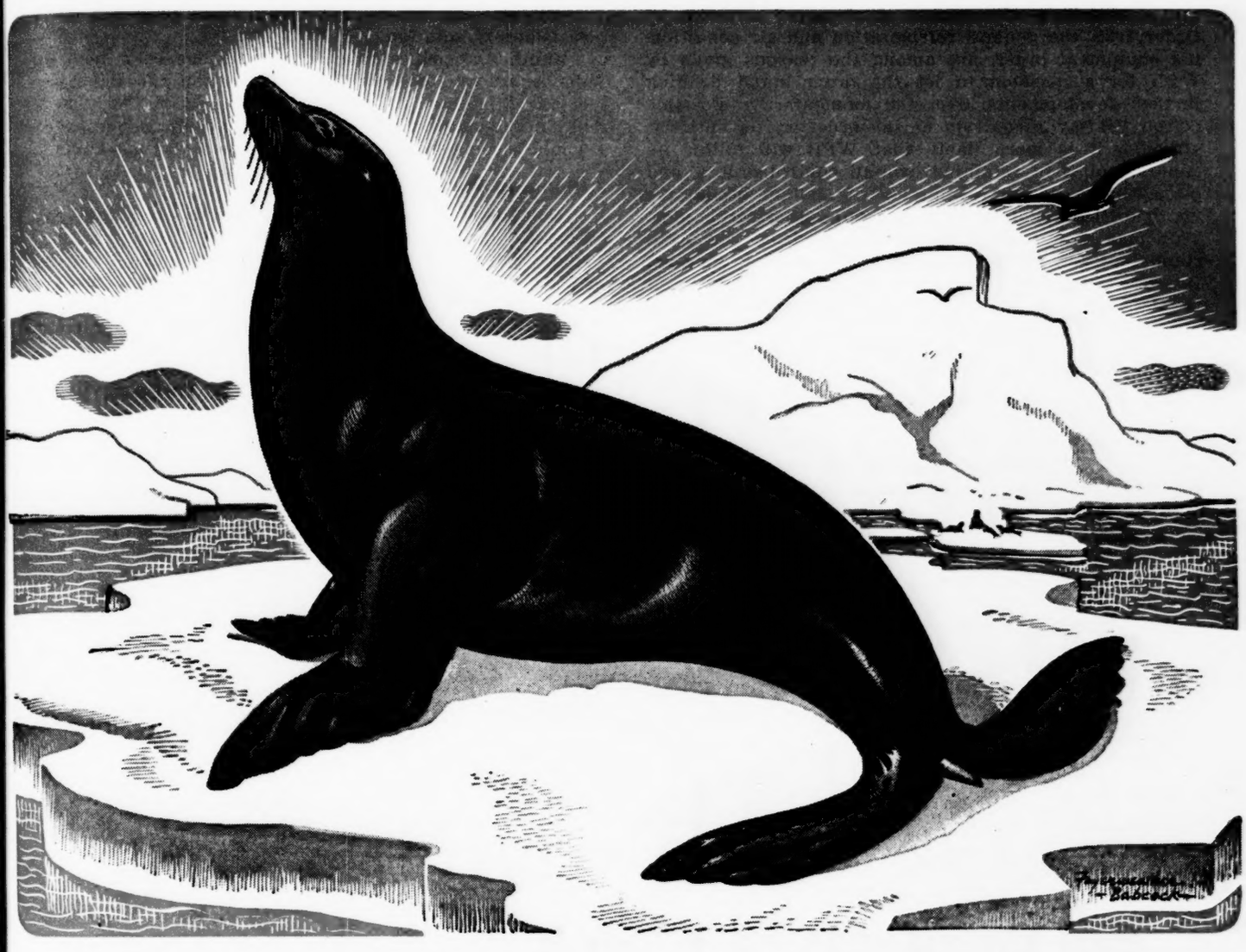
A-C IAC To Meet

Further details of the interim policy, together with any new developments that may have taken place in the meantime, are to be discussed on May 9 at a Washington meeting of the General Refrigeration and Air-Conditioning Industry Advisory Committee. The April meeting of the IAC was deferred, partly because of the volatile state of subjects affecting the industry and partly because WPB had under consideration a proposal to reorganize the committee into several specialized groups.

With the announcement of the interim conversion policy and the possibility that an early VE-Day would result in developments affecting the entire industry, it was decided to continue the over-all committee and let happenings at the May 9 meeting determine future policies.

L-38 Revision Unlikely

Differences of opinion between industry advisory com-



It's easier to insulate a streamlined job

NATURE found it comparatively simple to insulate a streamlined job like the seal, but did you ever try to wrap up a giraffe? Men who have to insulate flanged or threaded fittings in a piping system will readily understand the comparison. By the same token, Tube-Turn welding fittings give a streamlined silhouette which is easily insulated, with never a leak to cause insulation replacement.

Other Tube Turns advantages directly related to cost include lighter weight, greater strength, longer life, and the consequent lower maintenance. Smooth turns free from obstructions make for increased efficiency of flow. And Tube-Turn welding fittings permit installation of a piping system in less space, with greater flexibility of layout.

For complete information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111.

Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

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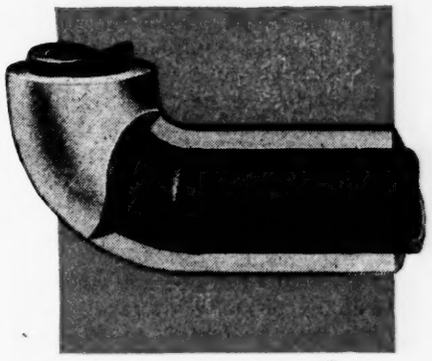


Smooth, permanent insulation

Because Tube-Turn welding fittings make smooth, leak-proof turns, insulation goes on easily, never needs to be removed because of leaks.

TUBE-TURN TRADE MARK *Welding Fittings and Flanges*

mittee members with regard to proposed revisions of Order L-38, the general refrigeration and air conditioning equipment order, are among the reasons given by WPB for a decision to let the order stand pending further developments, expected momentarily. Possible is the VE-Day revocation of the order in its entirety, although it is more likely that WPB will follow its general policy of retaining over-all control orders, and permitting a liberal resumption of civilian production via Priorities Regulation 25—the spot authorization plan. This plan would have the advantage, from the WPB standpoint, of flexibility, giving the War Production Board a checkrein which could be applied in the event the Japanese war calls for greater war production than is initially contemplated.

M-28 Requires Explanation

When an amended Order M-28 finally authorized deliveries of Freon-12 to the long list of comfort air-conditioning outlets, WPB had to follow up with an explanation that the order did not authorize construction of new units—it merely made refrigerant available to existing ones. The order does, however, permit installation of Freon-12 in new as well as used equipment—a provision which could possibly result in the installation of some new equipment which has remained idle for lack of a refrigerant charge.

While WPB has virtually relinquished its control over end-use of Freon, it retains over-all jurisdiction over the refrigerant by a paragraph in the Order reading as follows: "Each producer shall hold his entire inventory of F-12 gas, together with all additional quantities produced or otherwise obtained by him from time to time, for delivery for such uses as may be authorized or directed from time to time by the War Production Board."

In the event of increased military needs, or other emergencies, this provision could effectively reduce civilian supplies to a point where the end-users previously on the prohibited "A" list would again find no F-12 in stock.

Surpluses Merit Study

Worthy of continued study by all whose activities center around the production, distribution and installation of equipment is the subject of surplus war material. Current offerings give little indication as to the quantity of major items of heating, ventilating and air-conditioning equipment that may become surplus, but the initial impact of the surplus program on other industries sounds a warning. It is the intent of the surplus property act to effect disposal with the least possible disruption of normal distribution channels. First disposals, however, indicate the necessity for industries likely to be affected to work closely with Surplus Property Board agencies during the still-formative planning stage.

Typical of problems which could develop is that in which a producer of gasoline-powered electric generator sets has protested to Washington that the proposed disposal of some 3,000 of the sets by the Reconstruction Finance Corporation as surplus could put his firm out of business, together with a dozen others manufacturing similar items. The manufacturer's wired protest to Washington says, in part:

"We request you to issue desist orders covering scheduled sales, and call meeting of RFC, Treasury Department, and U. S. Maritime Commission representatives and those representing this industry, to decide firm policies. Continued sales to all comers can destroy this specialized industry more easily than most others, inasmuch as *production for war exceeds production during thirty prewar years.* The stable post-war market can be flooded with equipment unsuitable for commercial use within one year if only twenty-five per cent of military units become surplus and are sold without regard for this manufacturing and distributing industry."

As a result of the protest the requested meeting was scheduled, and efforts are being made to work out a satisfactory solution.

Another appeal, similar in nature, has been filed by the American Road Builders Association and the Associated Equipment Distributors, who estimated that a billon dollars worth of tractors, bulldozers, pavers, etc., would become surplus, endangering post-war markets.

Planning Pays Dividends

That liaison between interested industries and the Surplus Property Board can result in satisfactory solutions is indicated by the experience of manufacturers of cutting tools. After conferences with industry representatives, the SPB has announced plans for immediate disposition of $5,157,000 worth of this equipment through the original manufacturers. Approval of the program was given, SPB explained, with the firm conviction that distribution through other channels might prove hazardous to the industry. By the end of the Japanese war, the SPB indicated, stocks are expected to be so large that chaos in the industry might result unless cutting tools are disposed of in an orderly fashion.

Under the plan negotiated with 235 manufacturers, all surplus cutting tools produced by the manufacturer are turned back to him, with reimbursement by RFC for the cost of handling, reconditioning, storing, etc. The contract provides for payment of 17½% selling commission to the manufacturer, who agrees to fill 25% of his dealer demand from government stock. Under this plan the industry will be enabled to complete 75% of its post-war orders with new tools, keeping plans in operation and labor employed, while gradually absorbing surpluses.

An early investigation of the full import of the surplus situation as it may affect the heating, ventilating and air-conditioning industries is indeed indicated.

'46 Oil Rationing Outlined

Regardless of the date of VE-Day, a fourth year of oil rationing is assured. OPA announced on April 20th that 1945-46 rationing will be continued on virtually the present basis, with allotments no larger — possibly slightly less. Rations will again be issued before the beginning of the new heating season (Sept. 1) to permit the movement of fuel oil into consumers' storage tanks during the summer and to free dealers' and distributors' tanks for storage of oil that must be accumulated for later delivery.

An important change from the present methods is that all period and fixed-value coupons will expire for consumer use on August 31.

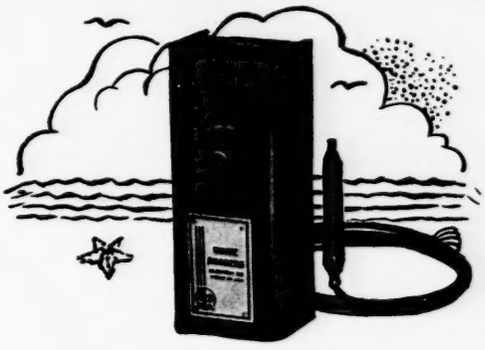
At the Twin Section Meeting of the ASRE

Faculties of the University of Minnesota and Wayne University of Detroit took over the Twin City Section of the ASRE at the March meeting in St. Paul. Left to right are Dr. F. B. Rowley, Head of the Mechanical Engineering Department and Director of the Engineering Experimental Station at the University of Minnesota; C. E. Lund, formerly Associate Professor of Mechanical Engineering, University of Minnesota, and now Director of Research, Seeger Refrigerator Co., St. Paul; Dr. S. A. Larson, Wayne University and guest speaker at the meeting; Dr. R. C. Jordan, Associate Professor and Director of Industrial Laboratories, University of Minnesota.

NOT AFFECTED BY ★ ATMOSPHERIC PRESSURE...

In the stratosphere or at sea level, in a mile-high airplane or on a tropical isle, White-Rodgers Hydraulic-Action controls *never* need adjustment or recalibration.

The completely sealed solid-liquid charge of the Hydraulic-Action element is tested before it leaves our plant, and will perform as calibrated no matter where you install it.



HYDRAULIC ACTION CONTROL

8 EXCLUSIVE FEATURES OF WHITE-RODGERS HYDRAULIC-ACTION TEMPERATURE CONTROLS

1. May be mounted at any angle or position, above, below or on level with control point.

2. Hydraulic-Action principle incorporating solid-liquid filled bulb and capillary provides expansion force comparable to that of a metal bar.

3. Diaphragm motion uniform per degree of temperature change.

4. Power of solid-liquid charge permits unusually sturdy switch construction resulting in positive contact closure.

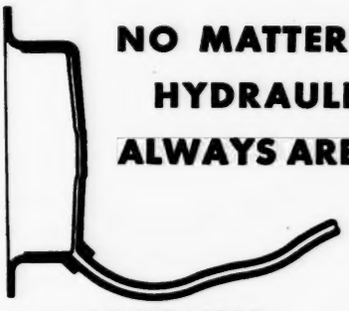
5. Heavier, longer-wearing parts are possible because of unlimited power.

6. Dials are evenly and accurately calibrated over their entire range because of straight-line expansion.

7. Controls with remote bulb and capillary are not sensitive to change in room temperature. Accuracy of control is not affected by temperature changes in surrounding area.

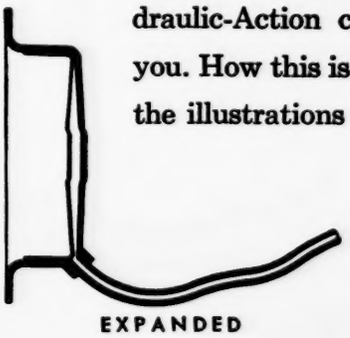
★ **8.** Not affected by atmospheric pressure. Works accurately at sea level or in the stratosphere without compensation or adjustment.

NO MATTER WHERE YOU PUT THEM HYDRAULIC-ACTION CONTROLS ALWAYS ARE ACCURATELY CALIBRATED



CONTRACTED

Above is a cross section of the diaphragm and part of the liquid-filled capillary. In this view the liquid has contracted, releasing the pressure on the diaphragm and causing the switch contacts to function.



EXPANDED

In this cross-sectional view, the liquid charge of the capillary has expanded with a rise in temperature. The positive force of this hydraulic action forces the diaphragm outward and causes the switch contacts to function.

Not having to worry about adjustments — fewer service calls — are advantages White-Rodgers Hydraulic-Action controls can give you. How this is done is shown in the illustrations below.

Actual-size illustration of the White-Rodgers diaphragm body, the actuating element of every White-Rodgers temperature control. It is so designed as to exert full pressure at the point of contact with the switch mechanism.

WHITE-RODGERS ELECTRIC CO.

1207E CASS AVENUE **ST. LOUIS 6, MISSOURI**

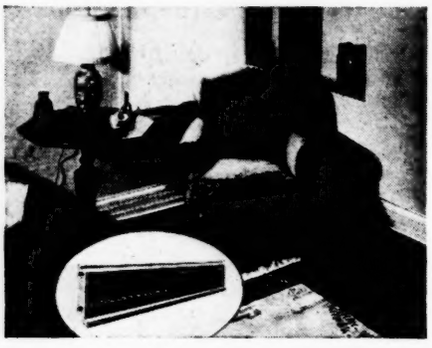
Controls for Refrigeration • Heating • Air-Conditioning

NEWS OF EQUIPMENT AND MATERIALS

Baseboard Heat Panel

NAME — Burnham baseboard heat panel.

PURPOSE — Contoured to resemble a typical baseball panel. Can be used on all types of steam or hot water installations instead of conventional radiators or convectors.



FEATURES—Unit is hollow cast iron 7 in. high, 1¾ in. wide, can be connected with usual heating boiler. Painted to match woodwork of room, it is difficult to distinguish panel from regular baseboard. Manufacturer reports that tests indicate floor to ceiling differentials are less than 3F when using panels. Sections of panels are joined by push-nipple construction with short tie bolts. Valves, ells and traps are connected at bottom ends as with radiators, these connections being concealed by a neat metal enclosure which is flush with front and top of panel. In addition to model illustrated, company has also developed a Hy-Power Base-Ray of the same dimensions but for increased output and with air inlet opening at bottom and air outlet at top for installations with larger than ordinary heat losses. Available in the post-war period for new houses and modernization.

SIZES AND CAPACITIES—Manufactured in 24 in. and 12 in. lengths, shipped assembled up to approximately 10 ft. Longer panels will be shipped in two or more pieces to be assembled on job.

MADE BY — *Burnham Boiler Corp., Irvington, N. Y.*

Steam Trap

NAME — Armstrong inverted bucket steam trap.

PURPOSE—Steam trapping for pressures up to 600 lb.

FEATURES—Designed for pressures up to 600 lb or where all steel fittings are desired. Has side inlet and side outlet connections. Flanges welded into trap body. Inverted bucket and valve lever are made of 18-8 stainless steel; valve and seat are chrome steel hardened, ground, and lapped. One of features of trap is that cap and interior mechanism can be removed for inspection or repair without breaking either outlet or inlet connections. Cap and working parts are removed as a unit by unbolting cap, leaving body intact on line.

SIZES AND CAPACITIES — Available with ½, ¾ or 1 in. screwed or flanged connections. Height is 11¼ in.; dimensions between flanges range from 11⅜ to 12⅛ in., depending upon pipe sizes.

MADE BY—*Armstrong Machine Wks., Three Rivers, Mich.*

Poly Phosphate Comparator

NAME—Taylor Poly Phosphate Comparator.

PURPOSE—To determine concentration of poly phosphate in water systems.

FEATURES — Low concentrations of poly (glassy) phosphates, such as hexameta, pyro and septa (threshold treatment), are coming into general use in power plants and hot water systems to prevent feed line deposition; in air conditioning and refrigeration units, and processes to prevent deposition and corrosion, to stabilize water and prevent corrosion (red water). Simple, rapid and accurate method of analysis is therefore desirable. Comparator is for this purpose. Previous methods required several hours boiling to convert glassy phosphates to ortho form. By Taylor method a complete determination requires 20 minutes. After conversion, two reagents are added separately and blue color formed is

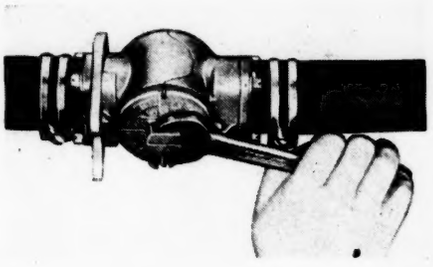
compared with standards. This gives total phosphate content. A determination on cold sample (no boiling) gives ortho present in sample. Difference is poly phosphate. Outfit consists of comparison block containing eight standards — 0, 0.5, 1, 2, 4, 6. 8, 10 ppm; 2 comparison tubes; funnel; filter paper; graduate; flask, and reagents. All equipment contained in wooden carrying case 9¼ x 6¼ x 9 in.

MADE BY—*W. A. Taylor & Co., 7300 York Rd., Baltimore 4, Md.*

Pipe Coupling

NAME — Thompson quick disconnect coupling.

PURPOSE—To provide a quick means for connecting or disconnecting hose and pipe lines, and at the same time seal the end of the disconnected sections against leakage.



FEATURES — The male and female halves of the unit are so designed that the male of one coupling will fit the female half of any other Thompson coupling of the same size. Two synthetic rubber seals are provided to seal the cylinders against leakage when in both the flow and non-flow positions. The coupling is disconnected by using a wrench to turn the wrench lugs a quarter turn. The coupling will then separate, each half sealing the line to which it is connected. The metal is anodized or colored to indicate the type liquids that can be used with each particular seal.

SIZES AND CAPACITIES—From ¼ to 2 in. Smaller sizes are supplied with integral fittings; 1½ in. and larger may be supplied with a variety of detachable fittings.

LITERATURE AVAILABLE — Illustrated folder which describes the coupling. Handbook of Instructions No. 6 with detailed drawings of the various size couplings.

MADE BY—*Thompson Products Inc., Cleveland 3, Ohio.*

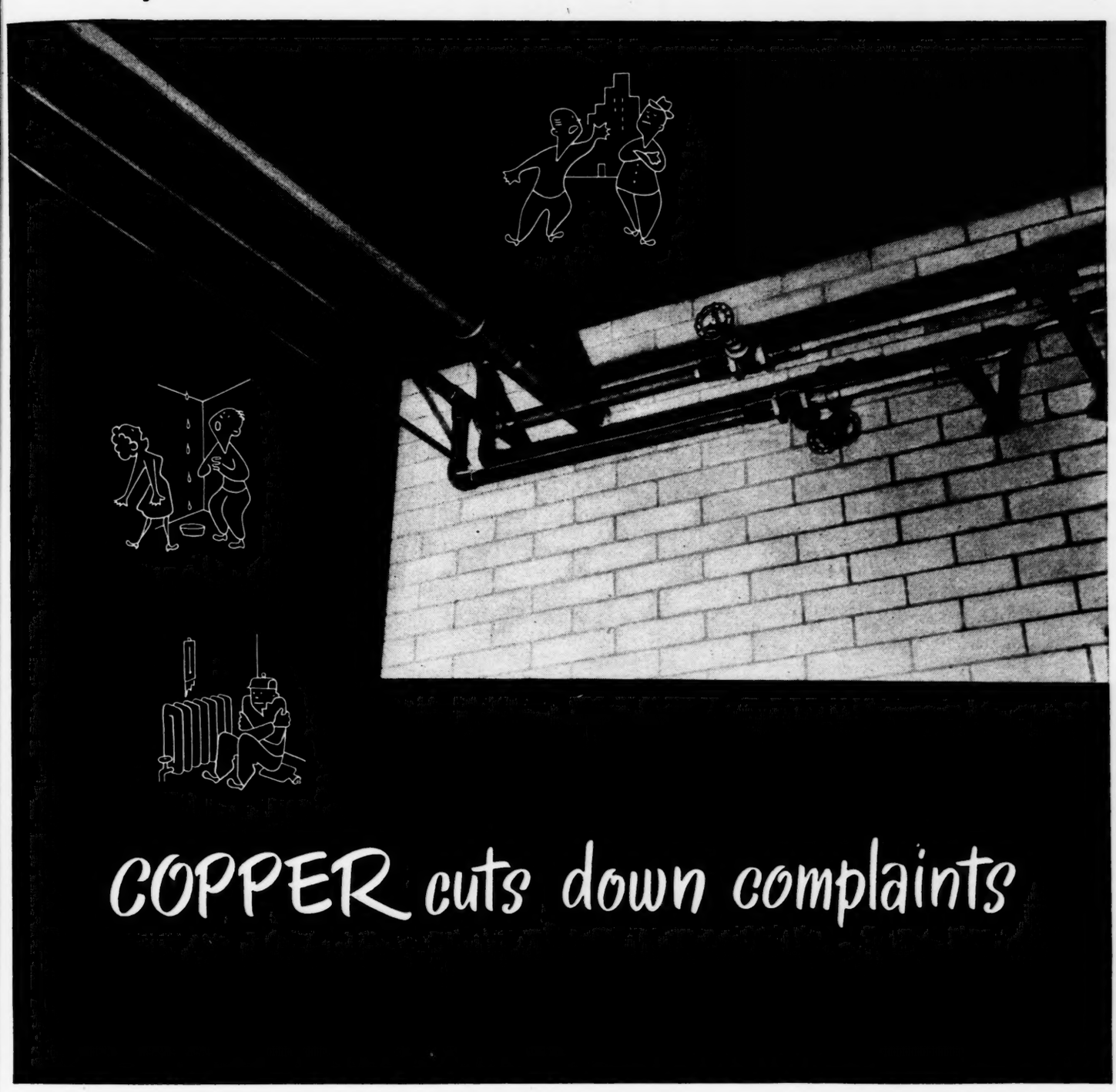
Dust Collector

NAME — Combined mechanical and electrical dust collector.

PURPOSE—For fly-ash collecting. Originally installed in the Huntley Power Station of the Buffalo-Niagara Electric Co.

FEATURES — Collector consists of a Thermix tubular collector working on the cyclone principle and removes about 80% of the bulk of the particles, together with a Precipitron which removes the smaller particles, with the net result that the air cleansing team is expected to remove up to 94% of all fly-ash particles from the power plant's smoke stacks.

DEVELOPED BY — *Prat-Daniel Corporation in collaboration with Westinghouse Electric & Mfg. Co.*



COPPER cuts down complaints

YOU know from observation that the owners and occupants of a building have hair-trigger tempers on the subjects of water supply and heating. Let the water run red or merely trickle, let a damp spot appear on ceiling or wall, let the temperature drop a few degrees—and telephones buzz with complaints. Water and heating lines of copper tube provide insurance against troubles such as these.

Revere Copper Tube (99.9% pure copper) is seamless and is cold drawn with a gun-barrel finish inside. It is deoxidized, and is free from flaws and blemishes. Joints are made with either soldered or compression fittings.

Designed for water supply, heating, air conditioning and other services, this tube is stamped with the Revere name and type at regular intervals. Look for these identification marks—they insure full wall thickness and the close gauge tolerances that are so necessary for tight sweated joints.

In making your post-war plans you can specify such long-lived Revere materials as copper tube and pipe; Red-Brass pipe; sheet copper for tanks, ducts, pans and trays; sheet Herculoy for tanks; Dryseal copper refrigeration tube (dehydrated and sealed); copper oil burner, heat control and capillary tubes.

Revere materials are handled by Revere distributors in all parts of the country. The Revere Technical Advisory Service, Architectural, is always ready to serve you. Call Revere.

REVERE

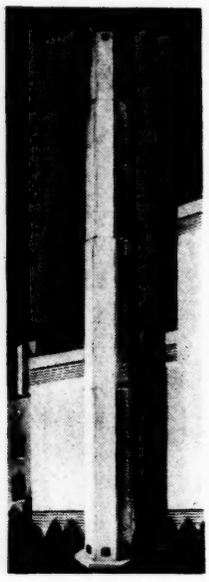
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N.Y.

Durabilt Stack

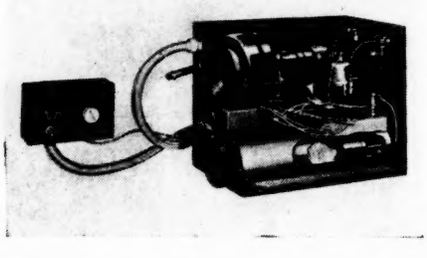
NAME—Durabilt smoke stack.
PURPOSE—For industrial and commercial applications.
FEATURES—Stack consists essentially of hexagonal steel structure braced throughout its length to resist high wind load, shock, lightning and earthquakes. Horizontal and vertical members are attached to steel structure and these support anchor and tile retaining castings. Each tile forming inner wall is individually retained. Outer tile is supported by channels at definite spacings. Any section of tile may be independently removed without affecting adjoining sections.



Outstanding feature of stack is its insulation. This fits securely between tile and retainer castings, providing low radiation loss, and helps to keep temperatures within the stack uniform, thereby improving draft. Being sectionally supported, there is no cumulative load upon fire-brick lining. Less foundation is required and weight savings of approximately one-third are said to be possible. Outer casing of stack can be of tile, sheet steel, Transite, or waterproof material. Air space is provided between insulation and outer tile throughout stack. Vents are located at bottom and top of stack.
SIZES AND CAPACITIES—Cost said to be comparable to a heavy duty stack; can be erected at any height from 50 to 300 ft.
LITERATURE AVAILABLE—Engineering data and other particulars.
MADE BY—*Chicago Fire Brick Co., 1467 Elston Ave., Chicago 22, Ill.*

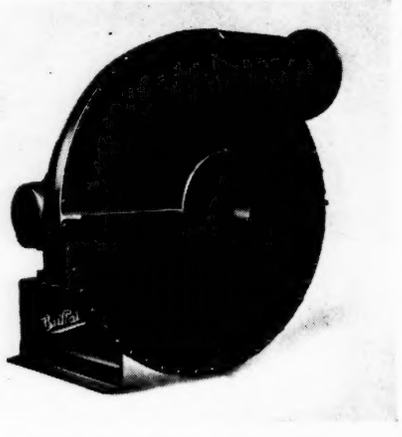
Truck Heaters

NAME—Fluid Heat truck heaters.
PURPOSE—For heavy trucks, trailers, mobile laboratories, busses, and similar vehicles, or for space heating of small isolated quarters. When mounted on wheels or runners, may be used for pre-heating engines.
FEATURES — Heater warms operator cab, defrosts windshield, heats cargo and personnel space, and can be used to pre-heat engine, manifold and crank case to make starting easy and reduce wear. Company's combustion process of vapor entraining, developed originally for aircraft heating, said to result in high efficiency.
SIZES AND CAPACITIES—Available in six sizes, smallest three having a high rate of heat output of 15,000 Btu per hr.; intermediate model with output of 25,000 Btu per hr.; and two large models with an output of 40,000 Btu per hr. Sizes range from 12 3/16 x 7 5/32 x 10¼ inches for smallest model to 18 15/16 x 13 1/16 x 10 13/32 inches for largest model.
MADE BY—*Fluid Heat Div., Anchor Post Fence Co., 6500 Eastern Ave., Baltimore 24, Md.*



Pressure Blowers

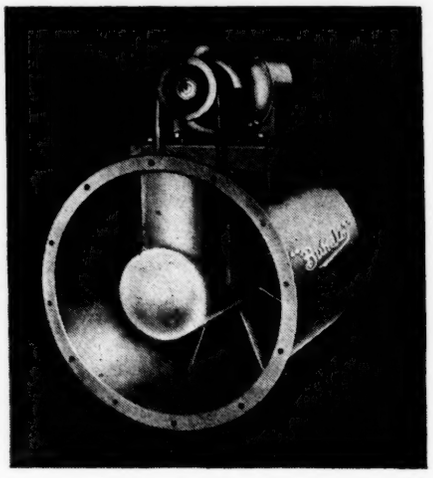
NAME—Buffalo type CB centrifugal blowers and type CC centrifugal compressors.
PURPOSE — Pressure blowers for industrial applications calling for high air pressures at low to moderate air volumes.
FEATURES — New efficiency and new economy are claimed for these two new lines developed from results of vacuum pit testing. All rotors are overhung on the shafts of the driving motors. Rotors are of steel plate, riveted or welded, balanced both statically and dynamically before shipment.



SIZES AND CAPACITIES—Type CB has a capacity range from 200 to 5,000 cfm and a pressure range from ¾ to 2 lb per sq. in. Type CC ranges in capacity from 4,000 to 75,000 cfm at pressures up to 4 lb per sq. in.
LITERATURE AVAILABLE—12-page Bulletin 3553.
MADE BY—*Buffalo Forge Co., Buffalo, N. Y.*

Buffalo Axial Flow Fans

NAME—Buffalo type B axial flow fans.
PURPOSE—Vaneaxial and tubeaxial fans designed to fill need for duct mounted fans for light duty common to ventilating and air conditioning in static pressures from ¼ up to 1½ in.

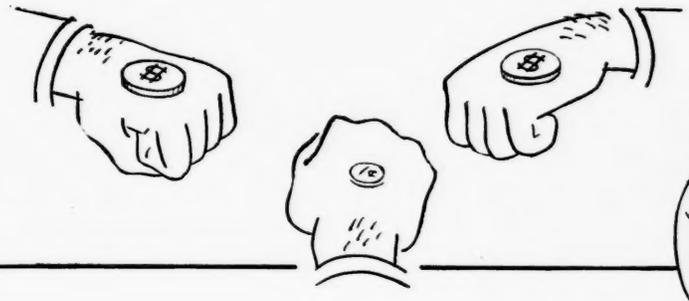


FEATURES — Moderately priced, a welded steel wheel is used, with large hub and varying blade pitch to give uniform air flow over entire blade. Large hub prevents re-entry losses common to ordinary propeller fan. Housings are heavy-gauge welded steel; rigid motor supports permit use of standard motors.
SIZES AND CAPACITIES—In belted or direct connected models, in capacities up to 45,750 cfm and static pressures ranging up to 1½ in. Belted models are vaneaxial only (with stationary directional vanes) direct connected. Models vaneaxial or tubeaxial (without vanes).
LITERATURE AVAILABLE—Twelve page Bulletin 3533.
MADE BY—*Buffalo Forge Co., Buffalo, N. Y.*

Insulating Tape

NAME—No Drip tape.
PURPOSE — An insulating tape for wrapping around piping to prevent drip from condensation or sweating.
FEATURES—Tape packaged three rolls to a package; each roll covers eight lineal feet of ½ in. pipe. Tape is applied to pipes when they are between 50F and 100F since, when warm, tape is pliable. Tape is brown but can be painted any other color with cold water paint. One wrapping is usually sufficient to overcome dripping. Directions are furnished for mounting tape around elbows, tees, valves and other fittings. Can also be used on tanks, which require different treatment from pipes. Special No-Drip adhesive is furnished for this purpose.
MADE BY—*J. W. Mortell Co., Kankakee, Ill.*

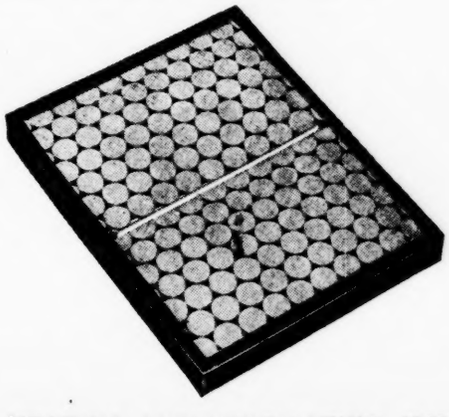
What's the CENTS of Air Filtering?



... it makes sense to obtain the advantages of filtered air *economically*. Air filtering is an important part of many manufacturing processes. It makes the difference between profit and loss, for countless commercial concerns. It assures greater comfort and cleanliness for millions of people. And when DUST-STOPS* are in the heating and air conditioning systems, it is a clear indication that filtered air is being obtained at both low initial and low maintenance costs.

PENNIES FOR DOLLARS

Where filtered air has a dollar value many Heating and Ventilating Engineers recommend DUST-STOPS and the complete ready-to-assemble steel frames as a sound investment.



The widespread preference for these replacement-type filters is based on their ready adaptability to any system, regardless of the cfm requirements; on flexibility of installation; easy access to filters; and the low cost of this part of the system.

WIN ON INITIAL COST

DUST-STOP Air Filters are highly efficient—are readily available at low cost from near-by suppliers.

DUST-STOPS are constructed of packs of glass fibers (Fiberglas*) coated with an adhesive and bound on the edges with a fiberboard frame.

The Fiberglas fibers, packed to proper density, form an exceptionally effective medium for air filtration. Being glass, they are inorganic, chemically stable, resistant to heat, corrosive vapors and being glass, they do not absorb the nonodorous, nonevaporating adhesive with which they are coated. Each impinged particle of dust is quickly soaked, acting as a wick to carry adhesive to other particles. Thus, the adhesive remains effective until the filter is so heavily loaded with dust that resistance to air flow calls for replacement.

WIN ON MAINTENANCE

Maintenance and replacement are accomplished with a minimum of man power and time. DUST-STOPS can be quickly obtained from near-by suppliers. And replacement requires no special tools or experience.

If you do not have complete information on DUST-STOP Air Filters, or typical installation details, see Sweet's Files or write:
Owens-Corning Fiberglas Corp., 1912 Nicholas Bldg., Toledo 1, Ohio.

In Canada: Fiberglas Canada Ltd., Oshawa, Ontario.

DUSTOP AIR FILTERS

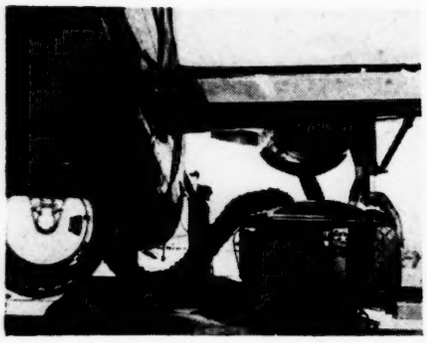
*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

—a FIBERGLAS product

Plane Cooler

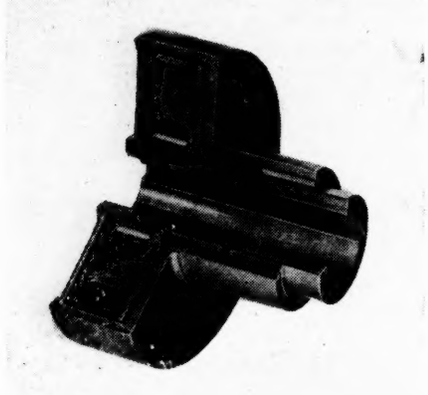
NAME—Carrier portable air conditioning and refrigeration unit.
PURPOSE—For furnishing cool and dehumidified air to workers finishing



or repairing planes. Illustration shows unit cooling B-24 Liberator.
MADE BY — *Carrier Corp., Syracuse, N. Y.*

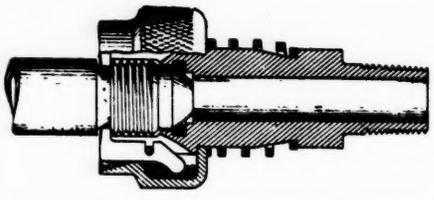
Mercury Clutch

NAME—Mercury clutch.
PURPOSE—A clutch to facilitate starting and acceleration of loads when internal combustion engines are used or with electrical motors where a slightly delayed action is necessary to allow motor to get up to speed before full load is applied.
FEATURES—Consists of a drum-like member attached to power source containing a small quantity of mercury confined in a narrow annular space. When this drum is revolved, centrifugal force urges mercury outward and pressure created acts directly on friction members, bringing them into contact with a drum attached to load. Only small quantity of mercury is required since hydraulic pressure created by head of mercury is independent of total weight of mercury. Therefore, this clutch is smaller and lighter than centrifugal clutch using weights. Clutch permits heavy mechanical loads to be started with smaller power sources than when directly connected. Starts loads from a standstill without shock or jolt and accelerates loads smoothly. It is claimed that the device reduces starting current, connected load, and improves power factor and absorbs shock loads. Its delayed action permits load to come up to effective speed instantly and without load, then applies power of motor smoothly to start and accelerate load at a rate which will not slow down motor unduly. When fully engaged is said to have a power transmitting efficiency of 100%. Illustration shows cut-away view of Type C-450 clutch.
SIZES AND CAPACITIES — Available in six models with diameters of 4- and 4½ in. and with maximum horsepower rating ranging from 2.5 to 7.5.
LITERATURE AVAILABLE—Complete file folder.
MADE BY—*Mercury Clutch Corp., 2039 Deuber Ave., S.W., Canton 6, Ohio.*



Wiggins Coupling

NAME — Wiggins direct-connect coupling.
PURPOSE—Especially designed for use in testing operations.
FEATURES—Fits over end of standard type AND 10056 nipple, "dogs" of coupling gripping securely in undercut just behind threads of nipple.



Connecting fluid or air line with coupling takes only a second, it is claimed.
SIZES AND CAPACITIES — Six sizes ranging from ¼ in. to ¾ in.
LITERATURE AVAILABLE—Catalog.
MADE BY—*The E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23, Calif.*

Pressurizing Planes

The new G-E Jet, most powerful aircraft engine in the world, feeds warm air to the pressurized cabin of the Army Lockheed P-80, in addition to carrying out its major operation of driving this propellerless fighter faster than any other plane will fly, according to General Electric Company.

Air flows from the impeller-compressor of jet engine into enclosed cabin, where pilot sits in relative comfort even when plane is going at lightning speed in substratosphere. Temperature of air is controlled, making it unnecessary for pilot to be swathed in heavy clothing. Pressurization of the cabin also makes it possible for pilot to breathe normally at altitudes of six miles and more without wearing an oxygen mask.

High Frequency Heating

NAME—Megatherm MD-1A.
PURPOSE—Portable unit to apply high frequency heating for a wide range of dielectric materials.

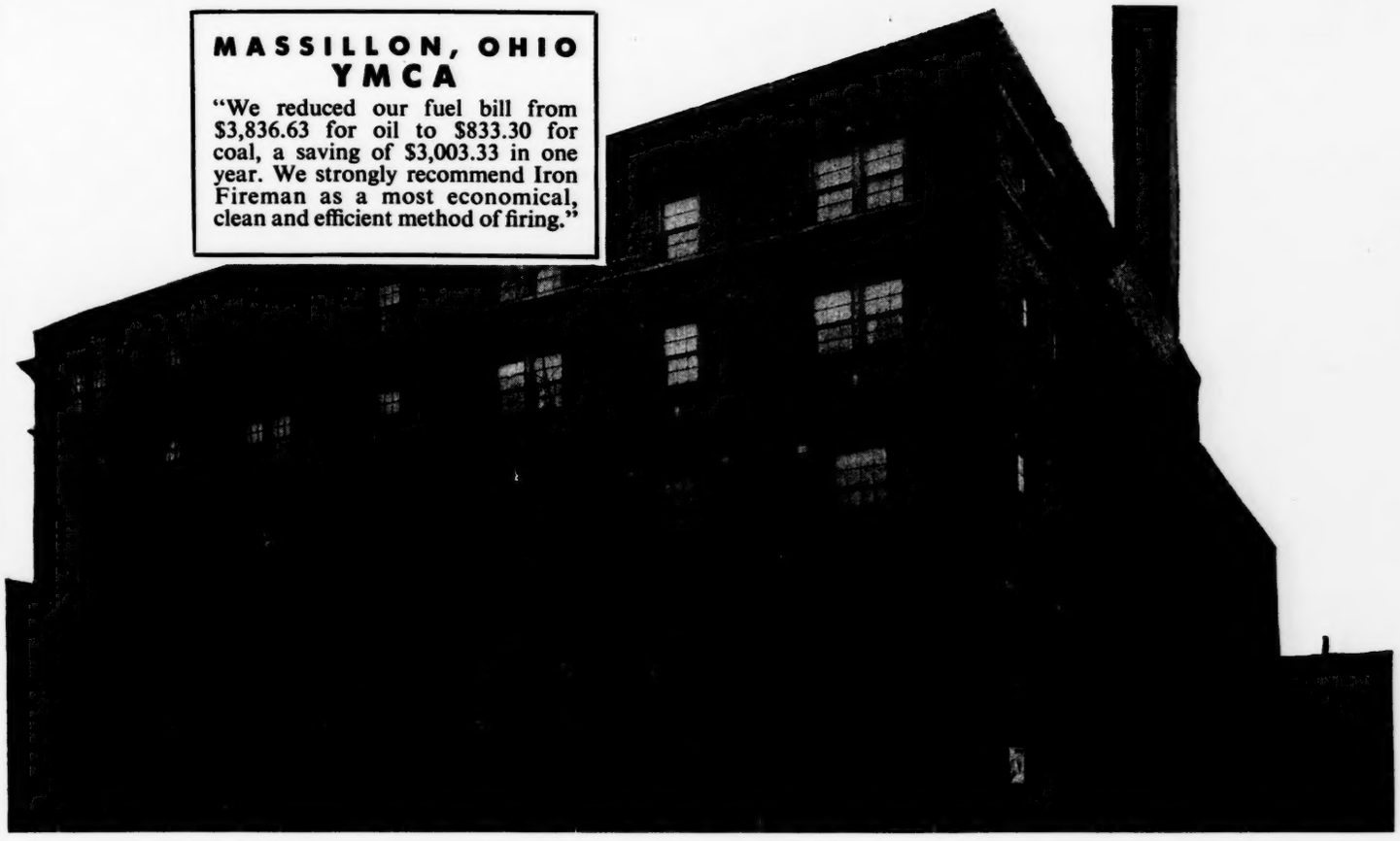
FEATURES—A detachable work oven is located on top of the cabinet, and is equipped with an inside light and window to permit the operator to view the work. A foot pedal opens the oven door. The duration of the heating cycle is controlled by an automatic timer. Model supplies 3500 Btu per hour at its operating frequency of 27 megacycles. Other frequency ranges are available for special purposes. Total power taken from line is 2 kva with an overall efficiency of 55% and a power factor of 90%. Dials on the front of the cabinet show operating conditions at all times. Model suitable for sterilization and dehydration of foods, and thorough-treating of wood, rubber, plastics and drugs.
MADE BY — *Federal Telephone and Radio Corp., Newark, N. J.*

Circuit Tester

NAME—Lo-Volt Test Glo.
PURPOSE—Circuit tester for circuits from 5 to 50 volts.
FEATURES — Device simplifies the testing of open circuits, burned out fuses, and can be used for indicating the relative value of line voltage. The incandescent "glow" lamp is protected by a transparent plastic housing. Overall length is only 7 in. Compact, can readily be carried in the pocket. Fully insulated test leads are 4 in. long.
MADE BY—*Ideal Commutator Dresser Co., 4169 Park Ave., Sycamore, Ill.*

MASSILLON, OHIO
YMCA

"We reduced our fuel bill from $3,836.63 for oil to $833.30 for coal, a saving of $3,003.33 in one year. We strongly recommend Iron Fireman as a most economical, clean and efficient method of firing."

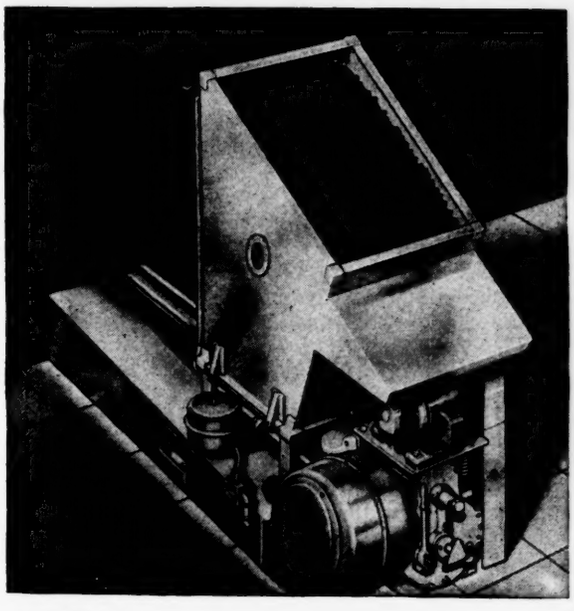


Conversion to Iron Fireman firing Cut Heating Costs 78% in the Massillon "Y"

ONE of the most important functions of the managements of buildings and institutions is that of providing uniform heat and plenty of steam and hot water at the lowest possible cost. A good example of alert business management is found at the Y.M.C.A. at Massillon, Ohio, where by installing an Iron Fireman stoker fuel bills were reduced $3,003.33 in a single year—a saving of 78%!

Because of the necessity for fuel and manpower savings and the need for more efficient heating plant operation, more and more Iron Fireman automatic coal stokers are being installed in buildings throughout North America. Such an installation will pay you substantial dividends by burning stoker-size coal, by saving labor, by smoke abatement, and by automatically supplying steady, controlled heat and hot water.

A heating plant survey, made without cost or obligation to you, will tell you what Iron Fireman equipment can accomplish in your building. The Iron Fireman engineering, sales and service organization covers the continent. Write: Iron Fireman Mfg. Co., 3804 West 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Iron Fireman—Pioneer and Leader in its field.



The Iron Fireman Poweram stoker (one of the many industrial models built by Iron Fireman), is designed for heavy continuous loads. It combines *worm feed* with *ram distribution* of coal. The worm conveys the coal to the retort in a loose, aerated condition; reciprocating blocks distribute it evenly and prevent packing.

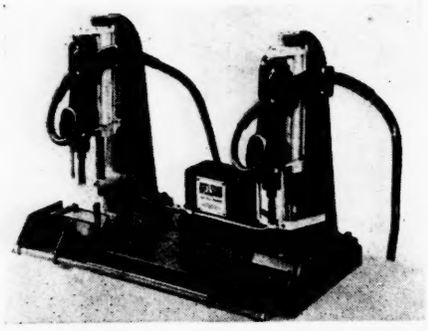
IRON FIREMAN

Automatic Coal Stokers

INDUSTRIAL • COMMERCIAL RESIDENTIAL

Stud Welder

NAME—Nelson multiple stud welder. production unit.
PURPOSE—For welding two or more studs at one time by mass production methods.
FEATURES — Each welding gun is



mounted on a pneumatic air cylinder. Each cylinder is fixed to movable arbor which can be adjusted to any spacing necessary for work. Work is held in mandrel, chuck, or special locating device, setup being determined by particular production problem at hand. Welding current is obtained from conventional 400 amp. generator, and is regulated by timing control unit which automatically controls length of arc flow. Unit is operated with single control switch. Work is inserted, stud is fitted into chuck of each stud welding gun, and control switch pressed. First gun then descends, making weld. Upon completion of this weld next gun descends and welds. Guns then ascend automatically and work is removed. Each unit manufactured only on order.
MADE BY—*Nelson Specialty Welding Equipment Corp., 440 Peralta Ave., San Leandro, Calif.*

Vol-U-Trol Register

NAME—Vol-U-Trol register.
PURPOSE—Manually-operated air supply register for domestic forced warm air systems.
FEATURES—Designed to provide wide range of easily adjustable diffusion settings and control of air supply volume. Said to offer many advantages not found in conventional types. Curved extension front, together with individually adjustable diffusion vanes, permits adjustment so that any shape room can be blanketed with air regardless of register location. Over-all shape of unit was suggested by a leading industrial designer and surveys indicate wide acceptance among home owners. Operating lever projecting through center of register is used to change amount of opening of volume control blades, thus placing control of air supply volume at register. Because of this feature, need for balancing dampers in duct work has been eliminated. Has adjustable lock so mounted that register can be closed by operating lever and then reopened to previously determined point without further adjustment. Turning vanes are provided. Available in post-war period.
MADE BY — *Minneapolis - Honeywell Regulator Co., Minneapolis, Minn.*

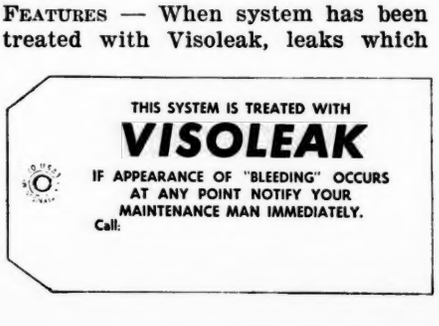
Welding Positioner

NAME—Standard welding positioner.
PURPOSE—For rotating work to be welded up to 700 lb. at speeds from 0 to 2.4 rpm in either direction.
FEATURES—To obtain a desired welding speed operator notes approximate radius at which welding is to be done and moves the control wheel until indicator is opposite desired welding speed in scale column for that radius. For sequence or step welding table may be positively started, stopped or reversed.
SIZES AND CAPACITIES—Positioner is 32 in. long (without motor dimen-

sions), 39½ in. long (overall with motor), 19 in. wide and weighs 665 lb. The table is 28 in. in diameter, ⅝ in. thick and rotates on an elevating screw of 2 in. diameter.
MADE BY—*Standard Machinery Co., Providence 7, R. I.*

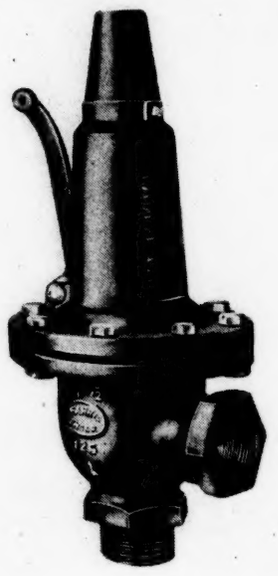
Visoleak Tag

NAME—Visoleak tag.
PURPOSE—To call attention of refrigerant equipment owners and maintenance men to possibility of leaks which might result in damage or loss of costly products and to be used where system has been treated with Visoleak.
FEATURES — When system has been treated with Visoleak, leaks which may develop are shown immediately by red coloring. Affixing of card at time of treatment warns personnel to fix as soon as color appears. Jobbers can obtain supply of tags through manufacturer.
MADE BY — *Western Thermal Equipment Co., 5141 Angeles Vista Blvd., Los Angeles 43, Calif.*


THIS SYSTEM IS TREATED WITH
VISOLEAK
IF APPEARANCE OF "BLEEDING" OCCURS AT ANY POINT NOTIFY YOUR MAINTENANCE MAN IMMEDIATELY.
Call:

Farris Relief Valve

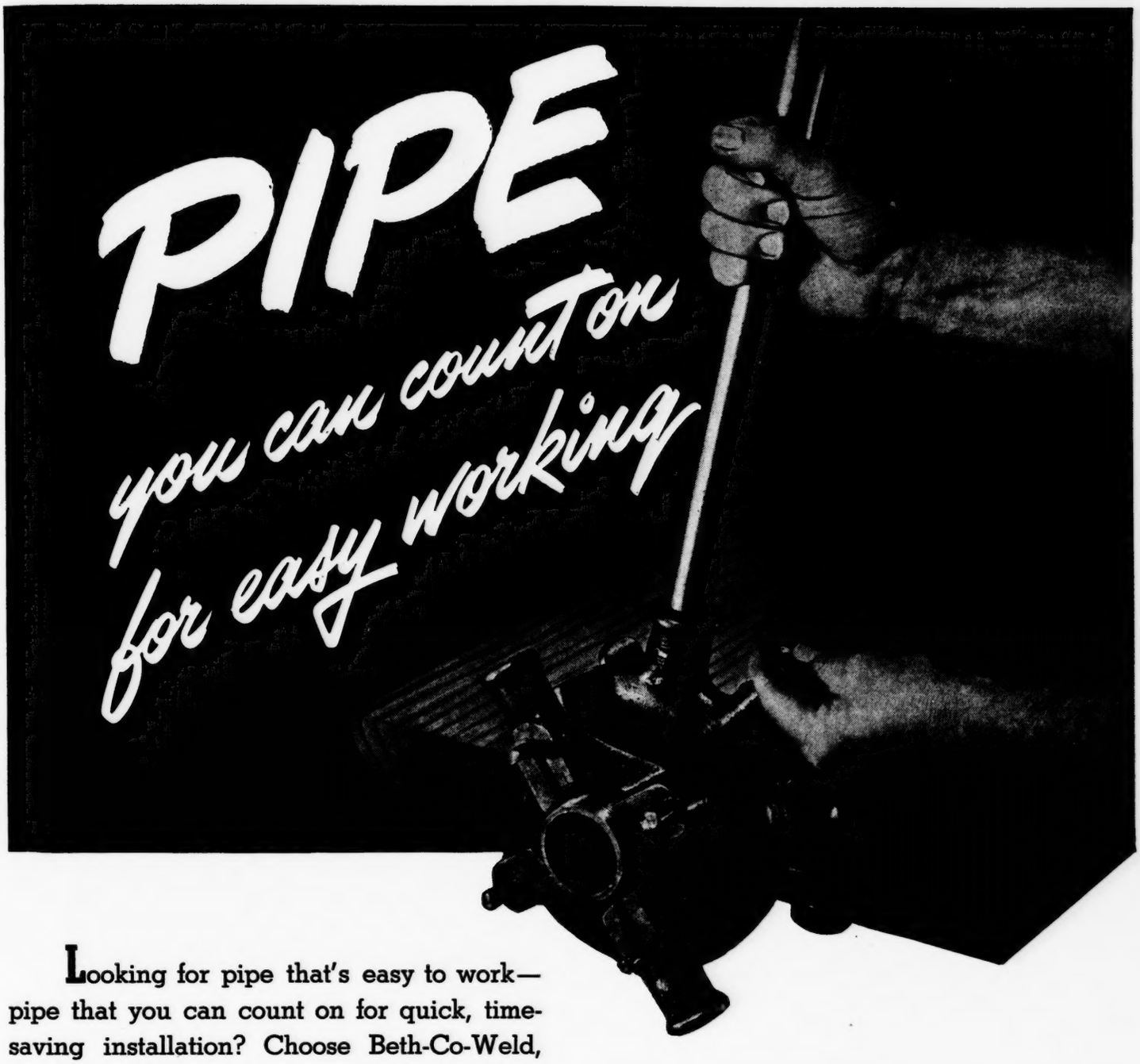
NAME—Farris diaphragm relief valve, type 1000.



PURPOSE — For industrial plants, marine services and other applications where a relief valve is to be used, and particularly where the relief valve, rather than a reducing valve, is to be used as a control valve for controlling the valve at the relief point.
FEATURES — Diaphragm seals valve from leakage encountered around stem in conventional design and, therefore, it is claimed, has higher acceptance for service where there is a fluid constantly on the downstream side. Will open to full relieving capacity at 20% overpressure. Will close at set pressure.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Farris Engineering Co., 345 Commercial Ave., Palisades Park, N. J.*

Circulating Fan

NAME—Roto-Beam safety circulating fan No. 130.
PURPOSE — Man cooling and air circulating applications.
FEATURES—Unit is a 24 in., 5 blade, 2 speed fan with a 110 volt, 60 cycle motor, enclosed by guard. Can be positioned through a full circle in both horizontal and vertical planes.
LITERATURE AVAILABLE—Bulletin P-12.
MADE BY — *Davis & Murphy, Davis Bldg., 5252 Broadway, Chicago 40, Ill.*



Looking for pipe that's easy to work—pipe that you can count on for quick, time-saving installation? Choose Beth-Co-Weld, the dependable steel pipe that is so widely used for plumbing and heating jobs because of its excellent working qualities.

Beth-Co-Weld is made of a superior grade of steel, on mills of advanced design. It has a tight, sound weld; every length is uniform in characteristics, uniform in quality. Beth-Co-Weld cuts and threads quickly and cleanly, welds readily. Using Beth-Co-Weld means reduced working time—better, more-economical plumbing and heating installations.

Your nearest Bethlehem distributor will be glad to tell you more about Beth-Co-Weld. He handles Beth-Co-Weld in all sizes up to and including 3 inches, black and galvanized, standard weight and extra-strong, and in uniform 21-foot lengths, plus or minus 1 inch.

BETH-CO-WELD PIPE

BETHLEHEM STEEL ★

Degree-Days for March, 1945

HEATING AND VENTILATING'S 18TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

CITY	MARCH			CUMULATIVE, SEPTEMBER 1 TO MARCH 31			HEATING SEASON[1]
	1945	1944	NORMAL	1945	1944	NORMAL	NORMAL
Abilene, Texas	169	366	273	2292	2424	2034	2061
Albany, New York	664	1116	980	5996	6316	5848	6580
Albuquerque, New Mexico	618	639	527	3883	4389	3970	4298
Alpena, Michigan	816	1227	1213	6455	6622	6873	8299*
Anaconda, Montana	1091	1182	1081	6467	6581	6737	8357**
Asheville, North Carolina	269	574	555	3366	3829	3831	4232
Atlanta, Georgia	162	395	388	2632	2724	2758	2890
Atlantic City, New Jersey	489	785	806	4188	4323	4437	5176
Augusta, Georgia	84	279	273	2020	2129	2137	2161
Baker, Oregon	884	932	880	5531	5693	5904	7163
Baltimore, Maryland	339	719	701	3870	4059	4163	4533
Billings, Montana	848	1111	955	5700	5654	6209	7119
Binghamton, New York	597	1067	995	5788	6160	5960	6808
Birmingham, Alabama	162	309	260	2447	2705	2283	2352
Bismarck, North Dakota	959	1435	1283	7182	7130	8152	9192
Block Island, Rhode Island	690	923	911	4745	4879	4678	5788
Boise, Idaho	772	827	651	4810	5123	4881	5552
Boston, Massachusetts	585	956	908	5002	5257	5230	6045
Bozeman, Montana	983	1153	1096	6345	6650	5993	8521**
Buffalo, New York	641	1084	1032	5752	6053	5800	6822
Burlington, Vermont	789	1227	1088	6736	7084	6584	7514
Butte, Montana	1088	1240	1048	6734	7113	6683	8272
Cairo, Illinois	269	546	539	3543	3677	3708	3909
Canton, New York	767	1226	1160	6971	7126	7002	8020
Charles City, Iowa	729	1143	1024	6360	6531	6752	7588
Charleston, South Carolina	77	212	242	1749	1775	1733	1769
Charlotte, North Carolina	177	441	428	2817	2919	2961	3120
Chattanooga, Tennessee	197	458	415	3133	3307	2974	3118
Cheyenne, Wyoming	939	1147	995	5875	6133	6174	7466
Chicago, Illinois	470	1014	902	5183	5655	5178	5957
Cincinnati, Ohio	347	764	676	4462	4522	4351	4684
Cleveland, Ohio	533	959	930	5169	5282	5371	6155
Columbia, Missouri	410	762	694	4405	4701	4597	4922
Columbia, South Carolina	116	332	301	2209	2329	2301	2364
Columbus, Ohio	432	854	778	4778	4880	4891	5398
Concord, New Hampshire	757	1140	1011	6355	6681	6332	7353
Concordia, Kansas	490	939	735	4398	4992	4908	5315
Dallas, Texas	132	319	267	2093	2333	2247	2256
Davenport, Iowa	479	983	893	5270	5521	5718	6289
Dayton, Ohio	453	897	744	5076	5220	4787	5264
Denver, Colorado	676	941	800	4573	4917	5073	5874
Des Moines, Iowa	552	1034	890	5357	5699	5825	6384
Detroit, Michigan	534	1050	973	5450	5752	5691	6490
Devils Lake, North Dakota	992	1545	1323	7739	8044	8694	9970
Dodge City, Kansas	494	828	688	4323	4905	4646	5035
Dubuque, Iowa	558	1060	958	5725	5957	6152	6790
Duluth, Minnesota	940	1341	1265	7379	7717	7945	9443
Eastport, Maine	884	1162	1110	6155	6615	6612	8520**
Elkins, West Virginia	467	826	763	5072	5218	5019	5697
El Paso, Texas	334	339	282	2397	2690	2383	2428
Ely, Nevada	1155	1105	—	6438	6533	—	—
Erie, Pennsylvania	574	1019	973	5126	5546	5407	6273
Escanaba, Michigan	937	1255	1262	6838	6908	7290	8771*
Evansville, Indiana	339	688	620	4182	4376	3968	4244
Fort Smith, Arkansas	226	439	397	2862	5053	3054	3147
Fort Wayne, Indiana	531	1021	818	5599	5838	5321	5925
Fort Worth, Texas	146	319	217	2110	2290	2121	2148
Fresno, California	447	314	316	2479	2322	2199	2334
Galveston, Texas	24	113	78	941	1141	1016	1016
Grand Junction, Colorado	708	768	672	4401	4802	5046	5548
Grand Rapids, Michigan	523	1057	964	5382	5773	5827	6535
Green Bay, Wisconsin	739	1183	1125	6434	6636	6903	7825
Greensboro, North Carolina	249	593	474	3470	3756	3319	3529
Greenville, South Carolina	183	453	446	2807	2949	3185	3380
Harrisburg, Pennsylvania	413	866	803	4693	4973	4880	5375
Hartford, Connecticut	589	962	887	5465	5600	5303	6036
Hatteras, North Carolina	258	412	465	2514	2535	2316	2571
Havre, Montana	925	1310	1169	6843	6406	7557	8700
Helena, Montana	978	1184	1004	6572	6720	6615	7898
Houston, Texas	28	133	65	1116	1278	1157	1157
Huron, South Dakota	804	1269	1092	6401	6874	7167	8004
Indianapolis, Indiana	390	830	756	4658	4878	4855	5298
Jackson, Miss.	118	—	—	1977	—	—	—
Kansas City, Missouri	423	801	691	4190	4656	4644	4956
Kewanee, Illinois	485	1020	884	5122	5833	5524	6139
Knoxville, Tennessee	224	482	496	3277	3410	3460	3670
La Crosse, Wisconsin	765	1096	1033	6163	6671	6611	7322
Lander, Wyoming	997	1191	1028	7178	7306	6694	7947

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

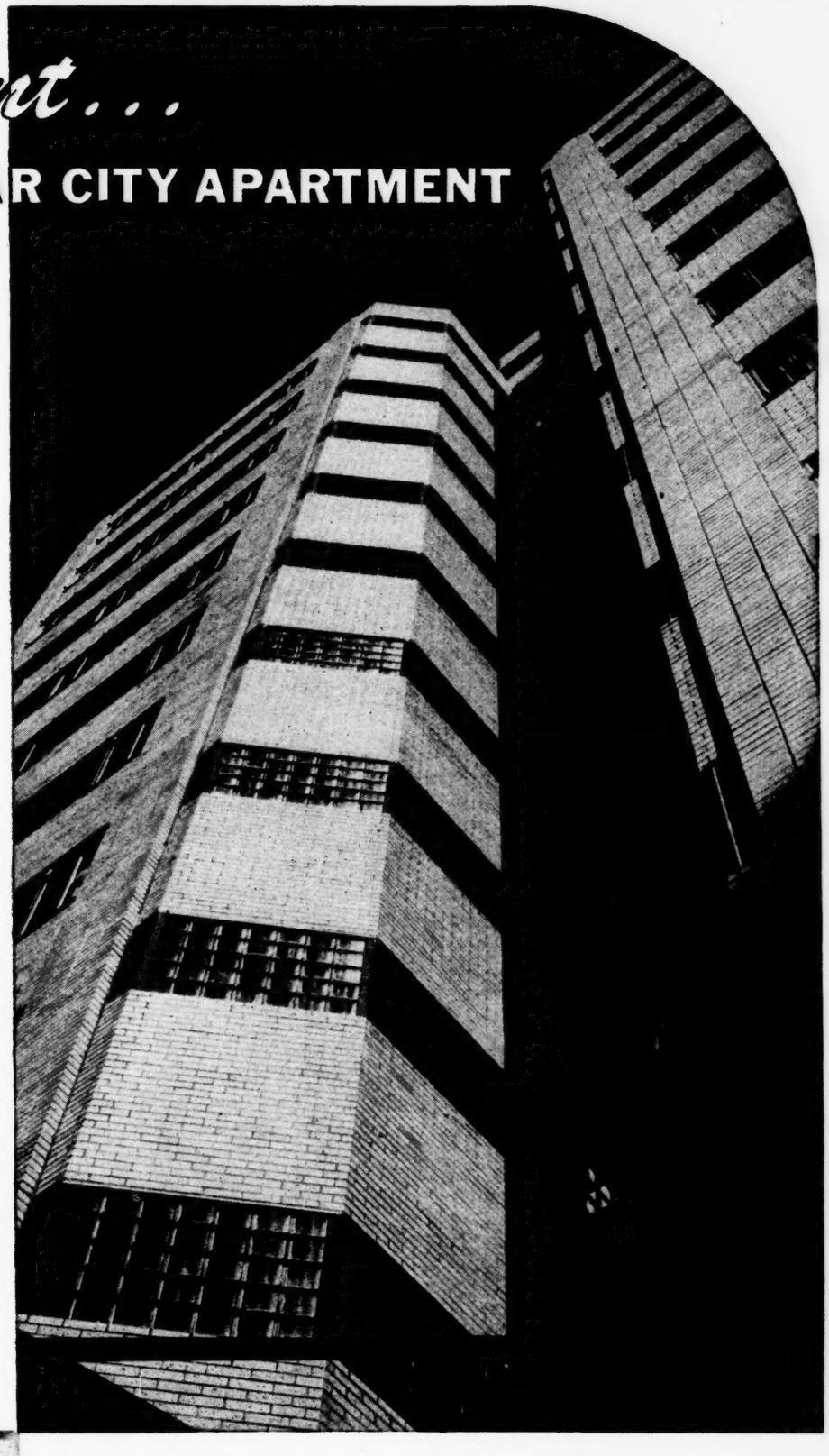
Figures in this table, with nine exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, Sioux City, and Jackson, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill., Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, and H. M. Ludlow, Box 1368, Jackson, Miss., respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

(a) Data not available.

[Table concluded on page 112]

Boiler Plant...

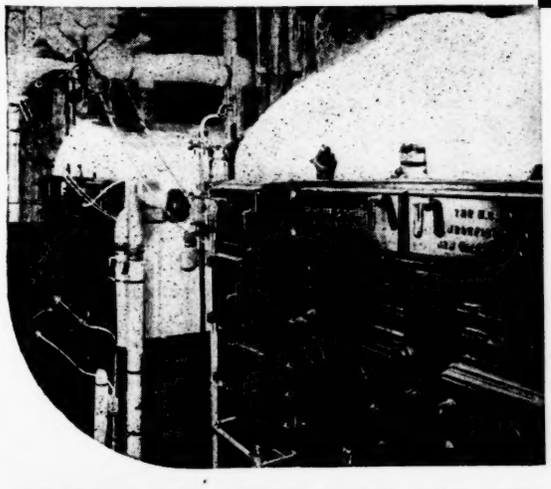
FOR THE POST-WAR CITY APARTMENT



Architects and Engineers, who are now confronted with the specifications of heating systems for apartment buildings to be built post-war, will do well to study New York City's Lusk Apartments, 25 East 83rd Street, New York City. The first. and only, completely air-conditioned building of its kind in New York City, it forecasts the type of system which may be expected in the future. By the use of individual apartment air conditioning units, with individual apartment controls, each tenant can completely control not only the temperature of his apartment in both summer and winter, but the relative humidity as well. Although erected seven years ago, it is considered today the most advanced Apartment Building for "living comfort".

The Architects for this modern structure were Frederick L. Ackerman, Ramsey & Sleeper, Associates. The office of Sullivan A. S. Patorno, Consulting Engineers, was responsible for the mechanical and electrical equipment.

The consulting engineers selected two No. 60 H. B. Smith oil-fired cast-iron boilers for this job because of long life expectancy and because their unusual flexibility of operation is expressly suited for this type of installation. This choice has proven doubly wise, for during the early stages of the war, when extreme fuel emergencies initially occurred, one boiler was converted to solid fuel (rice coal with a blower) at a minimum of expense. This enabled the Owners to use oil or coal, whichever available, thus assuring ample heat for the tenants, while still maintaining efficient and economical operation. It is this type of proven performance during war or initial periods that makes H. B. Smith boilers the best bet for today's planners of tomorrow's buildings.



H.B. *Smith*

CAST-IRON BOILERS

THE H. B. SMITH COMPANY, INC., WESTFIELD, MASS.

Branch Offices and

Sales Representatives in Principal Cities

Degree-Days for March, 1945 (Concluded)

HEATING AND VENTILATING'S 18TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

CITY	MARCH			CUMULATIVE, SEPTEMBER 1 TO MARCH 31			HEATING SEASON[1]
	1945	1944	NORMAL	1945	1944	NORMAL	NORMAL
Lansing, Michigan	579	1120	1035	5928	6307	6237	7048
Lewiston, Maine	842	1165	1093	6532	7056	6625	7707
Lincoln, Nebraska	527	1036	840	4820	5387	5483	5999
Little Rock, Arkansas	215	417	353	2866	2943	2733	2811
Livingston, Montana	879	1131	967	5832	5834	5985	7205
Los Angeles, California	336	179	239	1224	1125	1255	1504
Louisville, Kentucky	291	682	589	3941	4034	3916	4180
Lynchburg, Virginia	302	619	564	3843	3652	3707	3980
Macon, Georgia	95	254	260	2051	2223	2168	2201
Madison, Wisconsin	614	1147	1054	6096	6401	6611	7429
Marquette, Michigan	833	1284	1249	6570	6875	7164	8693*
Memphis, Tennessee	213	409	384	2983	3025	2854	2950
Meridian, Mississippi	125	246	245	2125	2239	2136	2160
Milwaukee, Wisconsin	643	1100	1023	5869	6260	6208	7245
Minneapolis, Minnesota	784	1212	1094	6532	6765	7044	7850
Modena, Utah	931	919	827	5418	5672	5591	6562
Montgomery, Alabama	82	211	208	1745	1943	1884	1884
Nantucket, Massachusetts	691	906	899	4662	4855	4811	5957
Nashville, Tennessee	234	503	477	3382	3425	3327	3507
New Haven, Connecticut	653	949	899	5202	5372	5129	5895
New Orleans, Louisiana	22	100	59	955	1192	1024	1024
New York, New York	453	872	837	4437	4762	4706	5347
†Nome, Alaska	1537	1508	1660	7995	8268	8886	14580**
Norfolk, Virginia	248	532	521	3012	3173	3104	3350
North Head, Washington	686	647	623	3422	3422	3755	5452**
North Platte, Nebraska	666	1060	875	5105	5637	5681	6366
Oakland, California	465	359	363	2426	2288	2392	3143**
Oklahoma City, Oklahoma	300	551	465	3103	3383	3451	3613
Omaha, Nebraska	588	1051	868	5194	5670	5633	6131
Oswego, New York	687	1121	1060	5819	6154	5993	7088
Parkersburg, West Virginia	374	763	670	4485	4624	4371	4775
Peoria, Illinois	484	952	862	5269	5608	5535	6109
Philadelphia, Pennsylvania	388	778	756	4168	4361	4385	4855
Phoenix, Arizona	244	220	152	1466	1468	1405	1405
Pittsburgh, Pennsylvania	416	833	787	4616	4881	4734	5235
Pocatello, Idaho	919	969	843	5819	6049	5696	6655
Portland, Maine	819	1113	1017	6353	6637	6105	7218
Portland, Oregon	588	551	558	3399	3403	3732	4469
Providence, Rhode Island	538	911	890	4820	5124	5206	6015
Pueblo, Colorado	666	829	732	4784	5181	4872	5514
Raleigh, North Carolina	208	503	446	3038	3218	3051	3234
Rapid City, South Dakota	880	1325	1010	5922	6291	6150	7118
Reading, Pennsylvania	411	840	794	4579	4794	4876	5389
Red Bluff, California	488	—	—	2425	—	—	—
Reno, Nevada	857	790	753	4934	5006	4902	5892
Richmond, Virginia	268	608	543	3423	3647	3449	3695
Rochester, New York	660	1096	1029	5960	6182	5854	6732
Roseburg, Oregon	604	560	546	3359	3472	3636	4428
Roswell, New Mexico	374	433	428	3017	3383	3304	3484
Sacramento, California	440	291	357	2399	2248	2393	2653
St. Joseph, Missouri	452	877	682	4483	4968	4803	5161
St. Louis, Missouri	356	735	657	4155	4280	4309	4585
Salt Lake City, Utah	788	891	722	4537	5407	4866	5555
San Antonio, Texas	45	176	74	1482	1644	1202	1202
San Diego, California	287	191	251	1216	1120	1350	1645
Sandusky, Ohio	499	964	915	5152	5316	5299	6208
San Francisco, California	409	286	353	2055	1845	2123	3264**
Sault Ste. Marie, Michigan	957	1394	1314	7373	7515	7629	9285**
Savannah, Georgia	47	142	167	1442	1455	1490	1490
Scranton, Pennsylvania	530	981	893	5447	5656	5445	6129
Seattle, Washington	599	589	620	3357	3441	3917	4934**
Sheridan, Wyoming	935	1162	1048	6091	6332	6837	8008
Shreveport, Louisiana	105	237	202	2016	2145	1938	1938
Sioux City, Iowa	703	1133	967	5776	6229	6245	6898
Spokane, Washington	844	867	778	5144	5381	5485	6355
Springfield, Illinois	471	831	760	5116	4926	4951	5373
Springfield, Missouri	407	687	626	4121	4356	4149	4428
Syracuse, New York	639	1120	1004	5922	6293	5984	6893
Tacoma, Washington	640	637	648	3699	3819	4086	5181**
Terre Haute, Indiana	372	794	663	4504	4747	4539	4872
Toledo, Ohio	540	1034	905	5644	5826	5372	6077
Topeka, Kansas	420	814	682	4162	4621	4635	4969
Trenton, New Jersey	430	842	735	4532	4791	4450	4933
Utica, New York	717	1195	989	6352	6708	5955	6796
Valentine, Nebraska	788	1263	980	5937	6372	6205	7039
Walla Walla, Washington	636	656	598	4077	4470	4274	4808
Washington, D. C.	329	688	694	3911	4099	4253	4626
Wichita, Kansas	420	746	648	3941	4297	4421	4673
Williston, North Dakota	986	1460	1280	7181	7177	8238	9323
Winnemucca, Nevada	844	893	767	5288	5432	5411	6427**
Yakima, Washington	700	704	620	4522	4820	5053	5599

†Nome data are for February.
(a) Data not available.

*Includes August.
**Includes July and August.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

WHEN HE SAYS

I think I can sell

GAS HEATING!

Be ready to check his ability through the Bryant Sales Talent Indicator Plan

It has been in careful preparation for many months . . . the Bryant Sales Talent Indicator Plan that now is ready to help guide you in the selection of your gas heating sales staff!

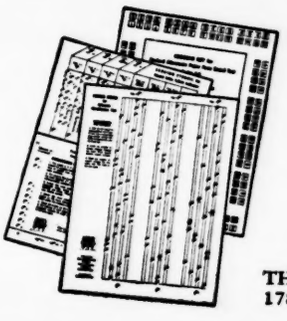
Created by the famed Personnel Research Institute of Western Reserve University, under the direction of Dr. Jay L. Otis, this plan is specifically designed to uncover for you the men best fitted to sell gas heating.

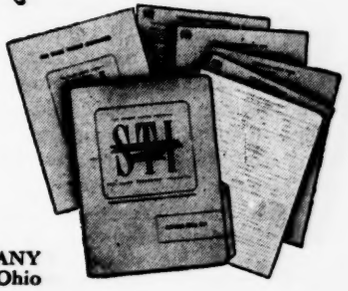
Not limiting a final judgment to any one form of test, it checks applicants from all possible approaches. *A weighted application blank* produces basic employment data. *A regulated interview and rating chart* reveals personal characteristics and work history. *A salesman classification test* determines the applicant's trainability. Then, *the Bryant Sales Talent Indicator,* key test of the plan, indicates in 20 minutes whether the applicant has the sales characteristics required in a successful gas heating salesman. And, if your type of selling also requires *mechanical aptitude,* there is a supplementary test to measure this ability.

Plan now to learn the details of this tested sales personnel selection plan, and how it can help you. Set a date for the Bryant representative to make a personal presentation in your office.

bryant
GAS
HEATING

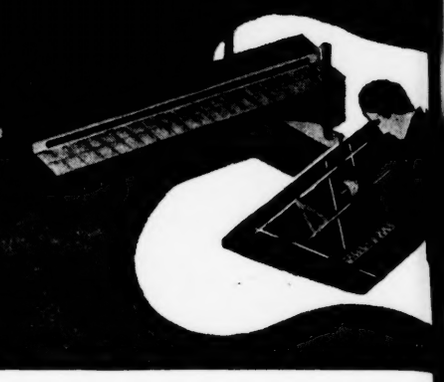
LET THE PUP BE FURNACE MAN





THE BRYANT HEATER COMPANY
17825 St. Clair Ave., Cleveland 10, Ohio
One of the Dresser Industries

REVIEWS



Articles are abstracted for the convenience of the readers. Orders cannot be taken for the full length articles. Those desiring to obtain copies of the article referred to should write to the publishers of the respective articles.

ASHVE GUIDE

The 23rd edition of the Heating, Ventilating, Air Conditioning Guide, prepared by the American Society of Heating and Ventilating Engineers, has just been published.

A 15-page detailed index, a single page quick reference table of contents, and a brief summary of chapter contents under each chapter heading provide easy reference to the subjects treated in the book.

The Guide contains 48 chapters of technical data and information grouped under the general sub-divisions, principles; heating and cooling load calculations; combustion and consumption of fuels; steam and hot water heating; air heating, cooling and conditioning; automatic controls, instruments and motors; special applications and miscellaneous. A change in format has increased the amount of text per page and consequently much useful information has been added.

Other changes in The Guide include: revised information on cooling tower practice in the chapter on spray equipment; a detailed presentation of fan laws and list of definitions of fans in the chapter on fans; extensive changes in the chapter on industrial exhaust systems with addition of tables and data for practical design purpose; a new section on electronic heating in the chapter on electric heating; a friction loss chart for flow of water in fairly rough pipe added to the chapter on hot water supply.

New edition, cloth bound, 6 x 9 in., contains 1216 pages; 808 pages of technical data; 344 pages of equipment data, and the roll of membership of the society. Published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10, N. Y. Available at $5 per copy.

REFRIGERATION AND AIR CONDITIONING ENGINEERING

"Refrigeration and Air Conditioning Engineering," by B. F. Raber and F. W. Hutchinson, is primarily a textbook for advanced students, either in college or out. It should be particularly useful for an elective course on "Refrigeration and Air Conditioning Engineering" for students who have completed their fundamental subjects, including calculus and thermodynamics, and are interested in a more general course in refrigeration and air conditioning engineering to coordinate, tie together, and expand the basic theory obtained in their previous fundamental courses.

This book will be equally useful to engineers for home study for review or refresher purposes. It covers, in 16 chapters, the fundamental branches of engineering in which a refrigeration and air conditioning engineer is usually interested. Many of the individual chapters would require one or more volumes of this size for a really complete and exhaustive coverage. Therefore, the data pertaining to each of the subjects are treated in a rather brief manner, and for complete information, the reader would find it convenient to refer to the many references quoted by the authors.

The authors have developed a number of graphical presentations which are most interesting. These should be particularly useful to students using this book as a classroom text or for engineers using it for home study, as they clearly illustrate fundamental relationships in a way more easily grasped and understood. Many diagrams are without scales, so that they are relative for illustration only. For students' use, this is an entirely practical method of presenting data.

This book apparently is not intended as a reference for design or application engineers in connection with specific problems, as it does not include a complete enough analysis for the former or enough specific quantitative data for the latter.

A good groundwork of mathematics and thermodynamics is necessary to read it with understanding. For technical engineers' use as a home study volume, its usefulness would have been improved by including answers to the various problems, either as a part of the book or in a supplement, so that the reader could check the solutions of problems. For classroom work, the omission of answers is undoubtedly desirable.

The authors are to be complimented for their skillful preparation of a very useful volume.

Cloth bound, 6x9 in, 291 pages and 18 folded charts in cover pocket. Published by John Wiley & Sons, Inc., 440 4th Ave., New York, N. Y. Price, $4.

Book review by L. Gale Huggins, Assistant Manager, Air Conditioning Division, Westinghouse Electric Elevator Co.

ANALYZING JOBS FOR THE HANDICAPPED

With the return of injured service men to this country, the important question that industry must face is how to best fit these men for gainful employment. Because of physical handicaps, they are limited in the type of work they can follow. To help in the difficult task of finding suitable jobs, the Dunwoody Institute, Minneapolis, Minn., has published "Analyzing Job Demands for Physical Handicaps of Veterans and Civilians." It consists of 19 mimeographed pages and two folded charts. The printing industry is used to show the method of analysis.

The study was directed by Fred J. Landon, and by R. T. Craigo, Assistant Director. H. J. Pierson, Head of General Shops and Sheet Metal Departments at the Institute helped in the preparation of the charts. Price of report, 50 cents.

RADIANT HEATING

In the review in the March issue of HEATING AND VENTILATING, page 104, of Cornell University's booklet Radiant Heating and Cooling—Thermal Environment and Radiant Heating, the bulletin was twice inadvertently listed as Part III of the series on Radiant Heating. Actually the booklet is the second in the series, the previous one having been entitled "Angle Factors for Calculations on Radiant Heating and Cooling."

Riveting exterior of motor coach with pneumatic gun.

A new, easier, and better way TO FASTEN SHEET METAL

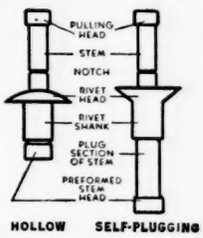
Assembling ventilator hood with Cherry Blind Rivets.

Cherry Blind Rivets are ideal for all duct work.

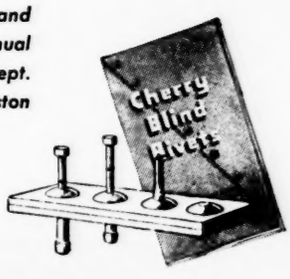
Riveting in tube with G-35 Hand gun.

You can do your difficult sheet metal fastening easier, quicker and better with Cherry Blind Rivets because they are designed for tough jobs . . . upset by one workman even in the most difficult spots, without the use of a bucking bar. They have generous tolerances in hole size and material thickness.

They have a patented pulling head on the stem which allows the use of small, lightweight, easy-to-handle riveting guns. They will upset in all sheet metals, in many soft and brittle materials, in tubes, ducts, stringers and curved surfaces. Cherry Rivets eliminate the disadvantages of such fastening devices as solder, self-tapping screws, nuts and bolts . . . are tight, strong, durable fasteners.



For a quick look at the many advantages and uses of Cherry Blind Rivets, write for Manual D-45 and metal demonstration panel, Dept. A-314, Cherry Rivet Company, 231 Winston Street, Los Angeles 13, California.



CHERRY RIVETS. THEIR MANUFACTURE & APPLICATION ARE COVERED BY U. S. PATENTS ISSUED & PENDING

Cherry Rivet *Company*

LOS ANGELES, CALIFORNIA

NEWS OF THE MONTH

University Tests Baseboard Heating

URBANA-CHAMPAIGN, ILL.—"Radiant baseboard" heating is the most recent development from research activities of the University of Illinois and the Institute of Boiler and Radiator Manufacturers.

Room warmth comes from a hollow cast iron baseboard supplied with hot water from a regular home heating boiler. Radiant baseboards replaced wooden baseboards along the bottom of outside walls in rooms of the I-B-R Research Home at the University during the severe past winter and proved completely successful. Pipe connections from the boiler are concealed in boxes at the ends of the baseboards. Installation was a relatively simple job.

The baseboard tested is slightly over 6 in. high and less than 2 in. wide, though appearing thinner because of molding at top and bottom. They are painted to match woodwork of the room and are hard to distinguish from the trim they replaced. Future installations may be recessed into the wall and extend into the room no more than an average wooden baseboard.

In previous years, with conventional radiators as heat sources, the floor-to-ceiling temperature difference in the I-B-R Research Home was 5 degrees in zero weather. This winter, with baseboard heat, the difference was never more than 3 degrees, even when the outdoor temperature dropped to subzero levels.

The I-B-R Research Home was built at the University in 1940 by the Institute of Boiler and Radiator Manufacturers to test home heating equipment and ideas under actual home conditions. It is a typical six-room well-insulated brick veneer small home of modern construction, completely furnished, and occupied.

Glenn L. Martin Elects Rowland V. P.

Harry T. Rowland

BALTIMORE — Harry T. Rowland was elected first vice-president of The Glenn L. Martin Company during the annual meeting of the Company held April 11 at its Middle River plant here. A native of North Carolina, Mr. Rowland graduated from West Point in 1923. He became actively connected with the Martin organization in 1936. Glenn L. Martin was re-elected president. Mr. Martin was also re-elected chairman of the board and Mr. Rowland fourth vice-president of the Glenn L. Martin-Nebraska Co., a wholly owned subsidiary. Joseph T. Hartson was re-elected president of the Nebraska Company. All Martin directors were re-elected.

Pipe Lab for U. S. C.

LOS ANGELES—Equipment for making hydraulic tests on pipes of sizes larger than can at present be made in any hydraulic laboratory in the U. S. is being installed in a new hydraulic testing laboratory opened in March in the Engineering Building at the University of Southern California, under the sponsorship of the university and the Pacific Coast Plumbing Inspectors' Association.

While only partly equipped at present, the laboratory is already engaged in test work in temporary quarters in the Engineering Building, where it is to be located until plans for a permanent building have been completed.

An endowment fund totaling $75,000 has already been subscribed through subscriptions and pledges from utility companies, valve and pipe manufacturers and distributors and other branches of the heating, air-conditioning and plumbing industries of Southern California and other sections of the Pacific Coast. Stephen I. Smoot, secretary of the association, announced in mid-April that architectural plans have been prepared for a new building to house the hydraulic laboratory on which work is to be started as soon as authority to proceed can be obtained from WPB.

It was said that the laboratory will ultimately be capable of making pipe tests which can be made by no other laboratory of its kind. Existing laboratories, it was pointed out, can test devices and pipe up to 2 inches in size. Taking into consideration the fact that factory installations for back-flow, etc., now use pipe sizes up to 8 and 10 inches, the U.S.C. laboratory is being fitted out to make tests on a complete range of pipe sizes, with equipment available to conduct the tests under conditions that prevail under actual working pressures.

$14.8 Billion in Specific Post War Building

NEW YORK—Mounting evidence of postwar construction demand is seen in statistics on postwar projects released recently by F. W. Dodge Corporation. Up to March 31, 90,700 specific projects contemplated for postwar execution had been reported by the corporation's field staff, the estimated total cost of the projects being $14,815,613,000. These projects were reported for the territory east of the Rocky Mountains, and consequently do not fully measure the potential postwar volume for the whole country.

Randolph Addresses IBR Regional Meetings

NEW YORK—Regional meetings are being held in various cities under the sponsorship of The Institute of Boiler and Radiator Manufacturers in order to acquaint the sales personnel of member companies with I-B-R Installation Guide No. 1. Meetings have been held at Northeastern University, Johns Hopkins University, New York University, Northwestern University, and Case School of Applied Science.

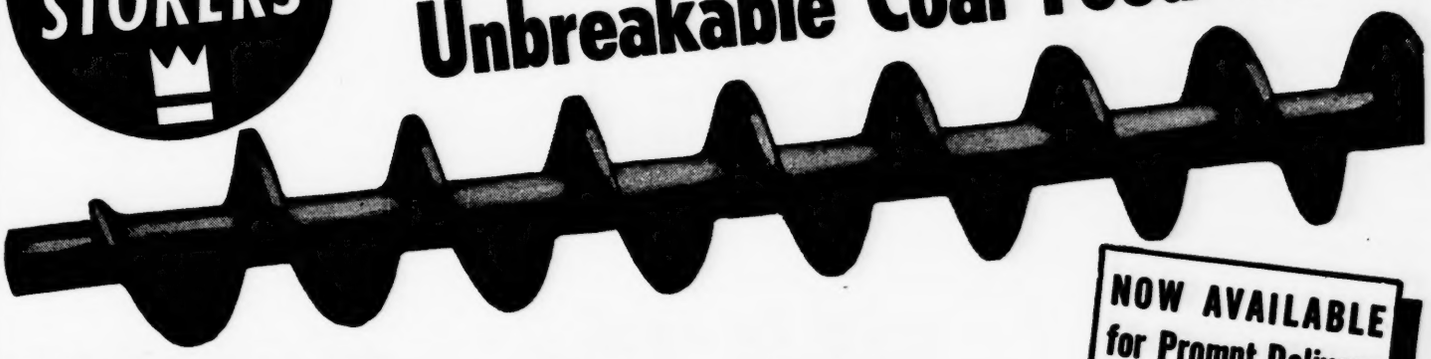
The meetings were conducted by H. F. Randolph, chairman of the engineering committee of The Institute of Boiler and Radiator Manufacturers, and R. E. Ferry, general manager. Attendance averaged 40 persons at each meeting.

The purpose of the meetings was to provide an opportunity for the sales representatives of manufacturers to review the Guide in detail and, under the guidance of Mr. Randolph, to calculate the systems for two different houses.

Sales representatives of IBR member companies at a meeting at Northwestern University. This was one of five such meetings.

For STOKERS

The CROWN Unbreakable Coal Feed Screw



NOW AVAILABLE for Prompt Delivery

WELDED All-Steel Worm—All Sizes—All Pitches

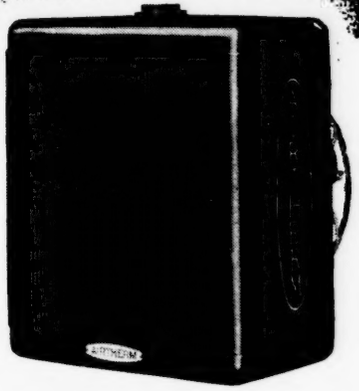
★Crown's complete line of all-steel Coal Feed Screws meets every replacement and production requirement. Produced for both domestic and industrial stokers. Crown Screws are available with right or left hand screw, in all sizes and pitches, tapered or straight, and in combinations of pitches. Uniformly smooth surfaces insure that coal will flow freely and easily through the flights. Because it is all-steel with continuous weld, the Crown Coal Feed Screw guarantees long, continuous operation with full customer satisfaction. Crown is in a position to make prompt delivery on all sizes.

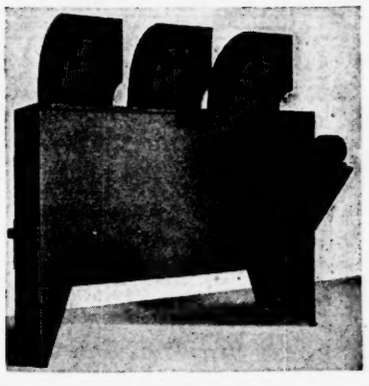
In ordering give complete specifications on size and design.

CROWN IRON WORKS COMPANY

1229 Tyler St., N. E. — *Since 1878* — Minneapolis, Minn.

Plan Now FOR NEXT SEASON'S HEATING REQUIREMENTS





Now is the time to be planning your heating needs for next season. There is an Airtherm Unit Heater to properly, efficiently heat any plant with a saving in fuel.

AIRTHERM PROPELLER TYPE STEAM UNIT HEATERS

Airtherm Steam Unit Heaters are individually controlled. They provide heat only where you want it, and when you want it. They are available in both vertical delivery and horizontal delivery types for ceiling or wall mount.

AIRTHERM BLOWER TYPE STEAM UNIT HEATERS

A high velocity unit which assures uniform temperature distribution and maximum heat flow effecting savings in both fuel and maintenance cost. This Airtherm Unit is suited to duct installation. Capacities range from 216,000 to 825,000 b.t.u.

Send us your specifications now. Our engineering department is at your service.

AIRTHERM
MANUFACTURING COMPANY
722 South Spring Avenue • St. Louis 10, Missouri

U. S. Starts Radiant Heating Research

WASHINGTON—Government sponsored research to obtain data on radiant heating is being planned as a joint project of the National Bureau of Standards and the Federal Public Housing Authority. Actual installations in buildings will be used as the basis of study.

The buildings, as yet in the blueprint stages, will be erected by the National Capital Housing Authority, a part of the FPHA, in Washington. Plans call for the construction of 3-story buildings containing 40 apartments. Twenty of the apartments will be heated by conventional radiator and convector systems.

Throughout each of the systems steam meters will be placed to record the volume of steam passing through the various mains and branch lines. Recording thermometers are to be installed in different sections of the buildings to make graphic records of the temperature 24 hours a day. Shut-off valves will be installed on branch lines so that the volume of steam may be perfectly controlled.

If conditions permit, an initial test will be made for several weeks without any occupants in the buildings. This period of testing should increase the validity of the results in that even distribution of heat can be assured before any differences in family preferences—for more or less outside air—enter the picture. It is believed, however, that the variation in preferences will be cancelled by the fact that there will be 20 families using each type of installation.

Hartford May Form ICI Chapter

HARTFORD, CONN. — More than 60 representatives of heating and allied interests attended an organization meeting in the auditorium of the Hartford Gas Company here March 13 to discuss plans for forming a local chapter of the Indoor Climate Institute.

At the Hartford meeting of the ICI are: (Left to right) George P. Luscombe, Electric Home Division of the Hartford Electric Light Company; Edward C. Marsden, of Marsden & Wasserman, wholesale heating equipment dealers; J. K. Knighton, sales manager of the air conditioning division of Servel, Inc., Evansville, Ind., and a member of the board of directors of ICI; and B. H. Dingley, sales manager of the Hartford Gas Company.

Edward C. Marsden, of Marsden and Wasserman, acted as temporary chairman and introduced John K. Knighton, sales manager, air conditioning division, Servel, Inc., who explained the nature and purpose of the Institute.

After questions from the audience a show of hands indicated a large percentage were interested in forming a Hartford chapter. Mr. Marsden said he would appoint an organizational committee of ten or twelve to be announced later, the committee to report at a later meeting.

A. C. in Wermacht Headquarters

BOSTON — In a special dispatch from Bad Nauheim, Germany, Voley D. Hurd, staff correspondent of the *Christian Science Monitor*, describes in detail the headquarters of the German Wermacht in which were planned the attacks on Poland and Western Europe in 1939 and 1940.

Calling it a dream castle, Hurd said that the basis of the layout was an old-fashioned stone castle on a secondary road with vast underground extensions and additional small camouflaged surface units, all now badly damaged by bombing. Entrance is through an old stone tower by concerete slab steps mounted in a steel and concrete column.

Walls are covered with white plaster and the rooms opening off a 500-ft underground corridor are equipped with tile baths, modern radiators, well insulated heating piping and fixtures of the best quality. Despite the great quantities of earth above and stone and earth outside, there is no indication of dampness, as the entire structure in extensively air conditioned.

Prefabricated Solar and Radiant Heated House Under Way

ROCKFORD, ILL.—A prefabricated solar house, a five-room ultra modern home constructed under a factory roof is being built in a wooded subdivision north of this city.

The house was designed and built here in the factory of Green's Ready-Built Homes. The Government granted priorities on materials for the house, which will be used for experimental and show purposes.

The Rockford solar house is rectangular, 58 feet 6 inches across the front, which faces south to take full advantage of the winter sun. The roof is flat and carries on it an inch of water in the summer to produce evaporative cooling.

A three-foot roof overhang allows a maximum of sunlight in the front glass panels in the winter and no direct sunlight in the rooms in the summer. The sun's rays, considered auxiliary heat, save a claimed 30% in fuel. The heater is a gas-fired furnace in the ground level utility room which forces warm air through tile ducts built into the floor.

Kitchen, dining room, living room and bedrooms extend along the front of the house.

Solid wall panels have external plywood and vertical siding on the outside, interior plywood and birch on the inside. Between the two surfaces of the panel are 3 inches of blanket insulation. Glass panels which form the entire front of the house are composed of sections of two pieces or heavy glass with 3-inch dead air space between to prevent moisture forming and reduce heat loss.

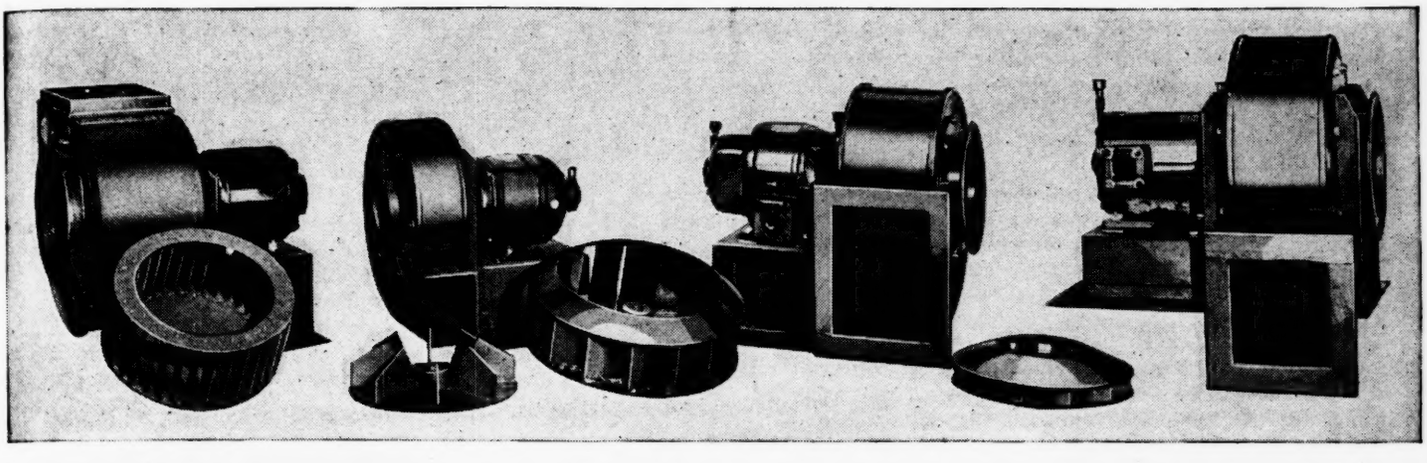
A layer of gravel covered by a layer of sand forms the foundation on which the hollow title heating ducts and return air ducts are laid in concrete. Flooring is laid directly on top of the heat ducts.

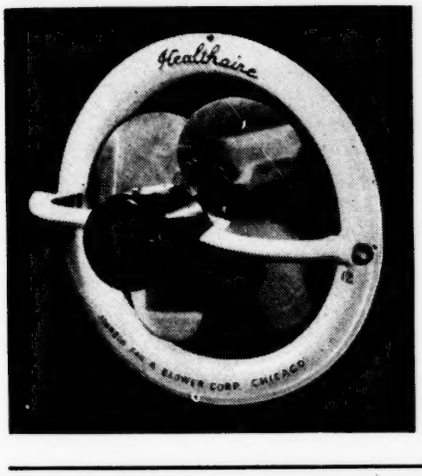
Cost of the house when completely equipped and furnished can only be approximated, but it is expected houses of this size will sell complete for between $6,000 to $8,500 exclusive of the lot.

EMPLOYMENT SERVICE FOR VETERANS

Position-wanted advertisements in HEATING AND VENTILATING are available without charge to returning veterans seeking positions in engineering capacities in heating, air conditioning, ventilation, piping and refrigeration. The advertisement should not exceed 25 words; identities will not be revealed. Address the Editor.

Johnson FANS AND BLOWERS *improved by continuous research*





Johnson Health-aire Propeller Fans and Blowers of various types are now available for industrial and commercial users. And back of every one of these products is the cumulative "know-how" growing out of more than twenty-five years of constant research, experiment, improvement, perfection. New units were created and added to the expanding line to keep pace with every modern requirement. Johnson engineers have solved literally thousands of ventilating and air-handling problems—their counsel is available to you at all times to help produce "climate as you like it."

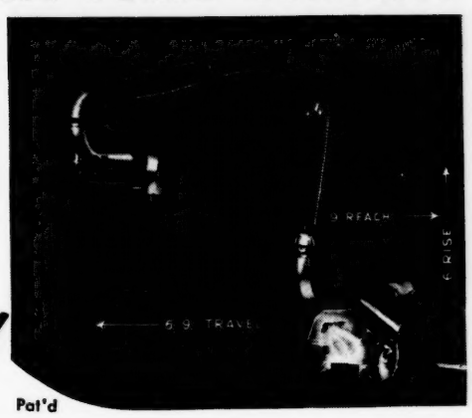
- BLOWERS (above) available from 6" to 50".
- PROPELLER FANS (left) available from 12" to 72".

★ **Johnson Fan and Blower Corporation** ★
1321 W. Lake Street **Chicago 7, Illinois**

RUEMELIN Fume Collector

•

Removes WELDING FUMES *at the Source!*



Pat'd

No longer need employees inhale welding fumes. A Ruemelin Fume Collector solves the problem, quickly and efficiently. Produces powerful suction that draws out noxious gases, smoke and heat *at the source*. Guards employee health, resulting in less welder fatigue, therefore greater plant output. Clears shop air with minimum loss of building heat. Covers maximum welding territory, vertically, horizontally and by circle swing. Shipped completely assembled, easy to install. 9 ft. and 15 ft. sizes available.

We gladly offer engineering service for your fume collector installation. Write for Bulletin 37-C.

RUEMELIN MFG. CO.
3898 N. PALMER STREET • MILWAUKEE 12, WIS., U. S. A.
MANUFACTURERS AND ENGINEERS
SAND BLAST AND DUST COLLECTING EQUIPMENT, WELDING FUME COLLECTORS

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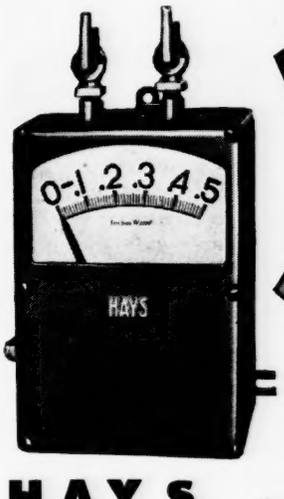


HAYS AIR-FILTER GAGE

- *Automatic*
- *EASY TO INSTALL*
- *SAVES MONEY*
- *ELECTRICALLY OPERATED*

If you are confronted with the problem of not knowing when the collected dirt in your filters is of sufficient density to decrease operating efficiency, install a HAYS Air-Filter Gage. The HAYS indicator shows amount of air resistance at all times—tells when to renew filter element—eliminates guess work—can be made to sound alarm when resistance is excessive. Write for full information. Ask for HAYS Bulletin A-F G.

The HAYS CORPORATION
SINCE 1921 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY INDIANA, U.S.A.

News of the Month

A. C. Buses for Post-War

NEW YORK—Air-conditioned buses with safety devices and other equipment to assure riding comfort and convenience were envisioned April 24 at a conference sponsored by the New York State Public Service Commission and attended by 100 vehicle manufacturers' representatives and bus-operating officials. The meeting was called to obtain ideas on post-war bus construction and the revision of regulations for this type of traffic with a view to increase safety on the highways.

M-H Starts Educational Program

CHICAGO—An impressive educational program got underway in Chicago April 4 and New York April 11, when the Minneapolis-Honeywell Regulator Company inaugurated what promises to be a nation-wide school for virtually everyone associated with automatic heating.

In preparation for more than a year, the "school" will be open to dealers, wholesalers, manufacturers, vocational schools, electricians, steamfitters, sheet metal workers and any others interested in heating, C. B. Sweatt, vice president, said in announcing the course at a meeting of Honeywell employees. There will be no charge of any kind.

In planning the course, the company also had in mind the rehabilitation of men of the armed forces who, by prior experience, or by choice, want to find jobs in some phase of the heating industry, he said.

"There is a real need for an integrated educational program in the automatic heating industry right now," Mr. Sweatt said, "and we believe all of those in the field will be anxious to catch up with new developments and learn proper installation and service methods. If our industry is to maintain its good will now and gain its rightful place in the postwar—and that means assuming a far larger share of the home building market—then all personnel must be ready and able to take care of the present maintenance work and prepare for the postwar business that is expected."

The courses will start May 1, he said, and will be held in all sections of the United States where company branches are maintained, and when a sufficient number of people indicate a desire to enroll. Prepared by M-H technicians in cooperation with a company specializing in visual education, the complete course extends for four 2½ hour meetings. More than 800 slides, many of them in color, are used, while simple but complete lectures fill in the details.

Primary purpose of the program is to teach the application of automatic controls and their installation and maintenance in connection with all types of heating systems using all kinds of fuel. The information to be covered has been divided into nineteen subjects with plans to cover several phases in each meeting. Subjects to be discussed are: control identification, circuits, thermostats, thermostat installation, limit controls, relays, controls for oil burners, summer-winter systems, oil burner systems, gas burner control systems, stoker systems, hand-fired systems, unit heater systems, zone controls, Weatherstat systems, Moduflow, and installation helps and service tips.

Enrollment cards for the courses are available from wholesalers, utilities, manufacturers, trade and vocational schools and other organizations in the industry, he said.

OHI to Start Burner Courses

BOSTON — A series of schools for oil burner service men and dealers will be started in a number of New England cities June 15, under the auspices of the Oil Heat Institute of New England. Otto T. Urban of Mason City, Ia., will be educational director, with headquarters in Boston.

Cities in which the sessions will be held are: Boston, Worcester, Springfield, New Bedford, Lowell, Salem, Mass., Concord, N. H., Montpelier, Vt., Hartford, Conn., Providence, R. I., Portland and Bangor, Me. The course will cover heating combinations, installations, user contact, analysis of oil burning problems, costs and general procedure. There will be about fourteen courses for each subject, given mainly evenings.

At its annual meeting, the Oil Heat Institute of New England elected the following officers: president, Edward P. Hacker, Portland, Me.; first vice-president, Francis Gilbane, Pawtucket, R. I.; second vice-president, Russell F. Swett; secretary-treasurer, Fred N. Beckwith.

MacDougall Speaks Before ASRE

SPRINGFIELD, MASS.—The Connecticut Valley section of the American Society of Refrigeration Engineers held its April 19th meeting here at the Hotel Sheraton. At this, the fourth meeting of the section, 96 members and guests heard Franklin M. MacDougall, chief engineer, Alco Valve Co., talk on "Low Temperature Expansion Valves." K. J. Helsing, Westinghouse Electric and Manufacturing Co., presented a talk on the "Tank Gun Stabilizer," followed by a sound film, "Fire Power with a Victory Wallop."

The meeting was presided over by Arthur W. Towson, Worthington Pump & Machinery Corp., chairman of the section.

The next meeting of the section will be held in Hartford, with M. M. Lawler, of Worthington, the speaker. The subject will be "Centrifugal Compressors for Refrigeration and Air Conditioning."

Harry L. Delander

CHICAGO—Harry L. Delander, a long-time member of the advertising department of Crane Co., died suddenly of a cerebral hemorrhage, April 13.

Mr. Delander completed 40 years of Crane service last December. He had filled almost every job in the department as changing conditions altered the company's advertising program. His latest interests were the editorship of *Valve World* and of the company's two internal house organs, one for salesmen and one for Crane men in military service.

Mr. Delander was one of the founders and the first president of the Engineering Advertisers Association in 1919, and an active participant in the launching of NIAA.

John H. Kitchen

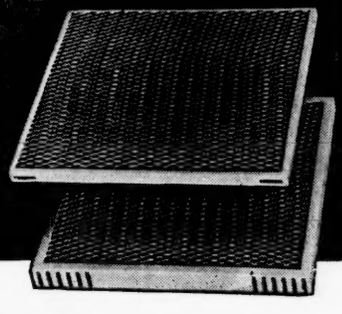
KANSAS CITY—John H. Kitchen, of the firm of John H. Kitchen & Company, died of a heart attack April 9 at his home here after an illness of two months. He was 75.

Mr. Kitchen organized the firm of Lewis & Kitchen, heating and ventilating engineers, and operated under that name until 1913 when the firm name was changed to its present form. He organized the Kansas City chapter of the American Society of Heating and Ventilating Engineers and has been a member of the national society since 1906. He was vice-president and director of the Chamber of Commerce in 1912 and 1913 and a member of the Sons of the Revolution.

He is survived by his wife, two sons, one of whom is F. A. Kitchen, president of American Warming & Ventilating Co.; a daughter, three sisters and three grandchildren.

The business will be continued under its present name.

You will want these Badger "Bonus" Features IN YOUR AIR FILTERS

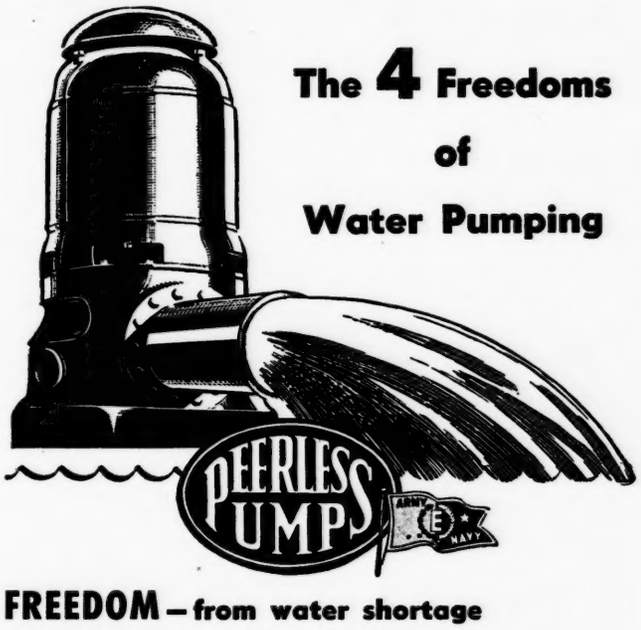


1. LONGER FILTER LIFE
2. GREATER DUST-HOLDING CAPACITY
3. HIGH FILTERING EFFICIENCY
4. LOWER FILTERING COSTS

Each of these definite advantages are yours when Badger Permanent Type Filters are used in your heating, ventilating, air-conditioning and industrial air-cleaning equipment. If you are not now familiar with the "Badger" story, send for the facts today.

Badger
CORPORATION
331 E. Brown Street
Milwaukee 12, Wis.

Manufacturers of Permanent Filters for Heating, Ventilating, Air Conditioning, Aircraft and Industrial Use



The 4 Freedoms of Water Pumping

FREEDOM — from water shortage
FREEDOM — from excessive power bills
FREEDOM — from pump breakdowns
FREEDOM — from costly repairs

PEERLESS PUMPS

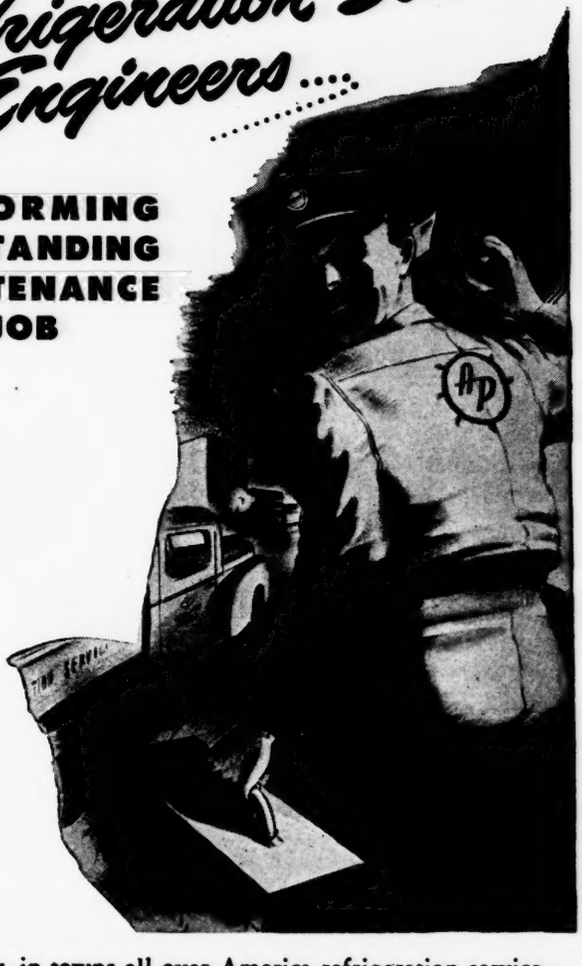
PEERLESS PUMP DIVISION
Food Machinery Corporation

TURBINE
HI-LIFT
HYDRO-FOIL

301 W. Ave. 26, Los Angeles 31, Calif. • 1250 Camden Ave. S.W., Canton 6, Ohio • Other Factories: San Jose 5, Fresno 16, Calif.

Refrigeration Service Engineers.....

PERFORMING OUTSTANDING MAINTENANCE JOB



Today, in towns all over America refrigeration service engineers are doing an outstanding maintenance job of keeping refrigerated display cases, ice cream cabinets, food storage lockers and the countless other applications of refrigeration running smoothly and efficiently.

On call the refrigeration service engineer performs his task, ofttimes while the city sleeps. Thousands of dollars he has saved retailers, countless thousands of pounds of precious food he has prevented from spoiling.

These men rely on A-P DEPENDABLE Refrigeration Controls. They use A-P DEPENDABLE Refrigeration Controls to help them perform their important task. As many of them write, "I use a lot of A-P Controls and never had one fail me yet."

A-P Model 205 Thermostatic Expansion Valve. Capacity up to 1 ton Freon.

AUTOMATIC PRODUCTS COMPANY
2462 North Thirty-Second Street
Milwaukee 10, Wisconsin
Export Dept., 13 East 40th Street, New York 16, N. Y.

DEPENDABLE *Refrigerant Valves*

Stocked and Sold by Good Refrigeration Jobbers Everywhere. Recommended and Installed by Leading Refrigeration Service Engineers.

. . . Since the Last Issue

Ellis L. Spray has been elected by the board of directors as a vice-president of the **Westinghouse Electric and Mfg. Co.**, in charge of elevator and air conditioning activities of the Company at Jersey City, N. J.

Ellis L. Spray

Westinghouse Electric Elevator Company has been dissolved as a corporate entity, and effective April 1 activities formerly handled by the Elevator Company, which was a wholly-owned subsidiary of Westinghouse Electric, are continuing as the Elevator and Air Conditioning Divisions of Westinghouse.

Until election to his new post, Mr. Spray had been vice-president and general manager of the Elevator Company. He began his career with Westinghouse in 1918 as an electrician's helper in the Company's East Pittsburgh Works. He became works manager at the Westinghouse Mansfield, Ohio, plant in 1922 and was appointed works manager at Jersey City in 1929.

Ross Rathbun and Walker G. White will continue as managers of the Air Conditioning and Elevator Divisions, respectively, Mr. Spray announced.

Robert H. McGinty has joined the **Chrysler Corporation,** Airtemp Division's field organization, as district representative in the Minneapolis-St. Paul area.

For four years before coming to Airtemp, Mr. McGinty was sales and engineering representative for Thermal Company, Inc., refrigerating and heating jobbers and distributors located in St. Paul. From 1939 to 1940 he was sales manager of Beecher-Cumming, Inc., Westinghouse distributors in the Minneapolis territory. Previous to that time and for nine years he was district commercial refrigeration representative for Northern States Power Company, St. Cloud, Minn.; and for one year was with the Dunning Company, Duluth, G.E. refrigerating distributors.

Wm. D. Graham is the new manager of the Greensboro, N. C., branch office of **The Trane Company,** La Crosse, Wis. This office, located at 504 Jefferson Standard Building, Greensboro, will serve the greater part of the North Carolina territory. Previous to his recent association with Trane, Mr. Graham managed the industrial heating and ventilating department for a prominent manufacturer of heating equipment.

W. H. Wheeler Inc., New York, has appointed **C. Gordon Jones** as chief engineer of its organization to enlarge its technical staff and present new developments in its air-conditioning field. The Wheeler organization is the general distributor of Airkem, chlorophyll air freshener. Mr. Jones for fifteen years was with the Bell System first as design and development engineer, operating and service engineer with the A. T. & T., consulting engineer with Electrical Research Products Inc. He was later director of operations of the Yankee network and has served in engineering capacities with John F. Marshall Co., Wesley Block Co. and E. B. Mathewson Co.

All New York City offices of **Surface Combustion Corp.,** with headquarters at Toledo, Ohio, have been consolidated at 315 Transportation Building, 225 Broadway, New York 7.

Methods of disposing of government-owned war housing that becomes surplus to war needs were announced April 28 by Philip M. Klutznick, Commissioner of the Federal Public Housing Authority. The **National Housing Agency** has been designated by the Surplus Property Board as disposal agency to handle the sale of surplus housing property and facilities, and has assigned disposal responsibility to its constituent unit, the Federal Public Housing Authority. The disposition plans, based on policies adopted by the National Housing Agency, will affect the bulk of more than 200,000 publicly financed permanent family dwellings, including demountables, which will become surplus either during or after the war. They also cover the disposal of most of the temporary housing declared surplus during the war.

Changes in officers and directors of **Iron Fireman Manufacturing Co.** have been made following a directors' meeting held April 17 in Portland, Ore. **Frank S. Hecox,** who has been secretary-treasurer, is now vice-president and treasurer, as well as director. **C. T. Burg,** general sales manager, becomes vice-president in charge of sales

Frank S. Hecox

T. H. Banfield

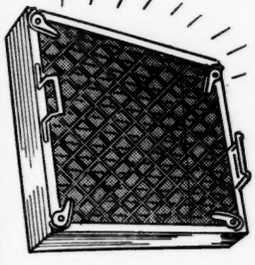
and remains a director. **Clifford W. Snider,** who has been comptroller, was made secretary. **Omar C. Spencer** has been elected a director in place of E. C. Sammons, who resigned to become president of the United States National Bank in Portland. Other officials in the new line-up, besides **T. H. Banfield,** president and general manager, are **Mansel P. Griffiths** and **T. Henry Boyd,** directors. Omar C. Spencer will serve as assistant secretary. Mr. Banfield, with C. J. Parker, founded the company in 1923, and has headed the business since the death of Mr. Parker in 1927. Mr. Burg has been general sales manager since the company's inception and a director since 1928. He is past president of the Cleveland Sales Executive club and regional director of the National Federation of Sales Executives. His headquarters are at the Cleveland plant. Mr. Hecox has

Clifford W. Snider

C. T. Burg

been associated with Mr. Banfield in Parker & Banfield and the Portland Wire & Iron Works since 1922 and has been secretary-treasurer, director and voting trustee of Iron Fireman since 1924.

Colonel G. deFreest Larner has been appointed assistant to the president of **H. K. Porter Company, Inc.** Colonel Larner will have charge of termination of war contracts, renegotiation, and special tax problems.



Easier Way to Clean Air Filters

Efficiency of air conditioning units is largely dependent on periodic cleaning of air filters . . . regular, complete removal of desposits entrapped from the air is necessary to maintain high filtering capacity.

If your filters are of the dry or viscous impingement washable type, you can clean them easily and effectively by using Oakite materials especially designed for this work. Dirt, dust, soot, lint, pollen and other foreign matter collected on surfaces are thoroughly removed . . . full filtering capacity is quickly restored . . . equipment out-of-service time is reduced to a minimum.

Specialized Oakite materials are available for expediting other essential air conditioning maintenance jobs. Write us concerning your problems. There's no obligation.

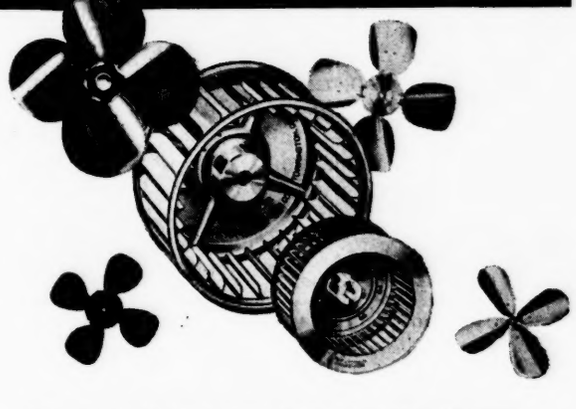
OAKITE PRODUCTS, INC., 58A THAMES ST., NEW YORK 6, N. Y.

Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE Buy Bonds for Victory **CLEANING**

MATCHLESS

PERFORMANCE



To secure matchless performance in any unit requiring the movement of air, it is essential to have the *correct* air impeller. Costly design changes and production delays may be avoided if you will let us help you make the choice *in the early stages of design.* Among the great variety of propeller fan blades and centrifugal blower wheels which we make, there will be one exactly right for your application.

The many factors to be considered in selecting an air impeller are listed on our Air Impeller Specification sheet. Write for one today, then submit it for our recommendation and quotation.

AIR IMPELLERS *for every purpose*

THE TORRINGTON
MANUFACTURING COMPANY. TORRINGTON. CONN.

You'll have to *WATCH YOUR PENNIES* in the PEACETIME COMPETITION

With the coming of peace and a return to the American way of producing goods at a profit in highly competitive consumer markets you'll *have* to be certain that every step from initial blueprint and tool design, through the machining, stamping and assembly line, up to packaging and delivery is planned and executed with utmost efficiency and with the minimum of cost.

In the production of war munitions Oiljak has maintained an enviable record of production of intricate parts and on time deliveries, in accordance with strict Government inspection—and has actually reduced the estimated and approved cost, thus saving the Government considerable sums, by skillful planning and supervision of the work. These same skills in metal manufacturing, improving designs and reducing costs are available to manufacturers as they convert to peacetime merchandise. It may transmit your penny savings into dollar profits to confer with us on any metal manufacturing problem.

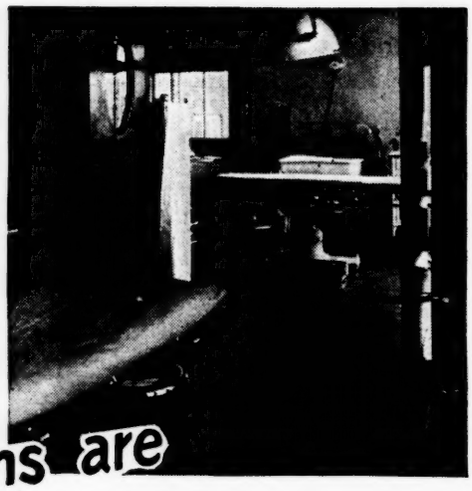
Machining • Stamping • Welding • Plating • Finishing • Assembling

The OILJAK Mfg. Co., Inc.

ARMY E NAVY

MONTCLAIR, N. J.
METAL MANUFACTURERS

THE JOB COMPLETE . . .
from blueprint to finished product



Two operating rooms in a 75-bed hospital, which are air conditioned with Frick equipment.

Operations are safer with

FRICK

Air Conditioning

Hospitals are finding year 'round air conditioning an indispensable aid in operating rooms. Patients, doctors, and staff are all greatly benefited by its controlled temperatures and invigorating freshness.

Years of experience in this work have taught us how best to satisfy the special requirements of operating rooms.

High relative humidity is necessary to carry away static electricity; explosion-proof motors and switches are used; fresh conditioned air is admitted in unusually large proportions: controls are automatic, but can be instantly adjusted by the surgeon. Drafts, noise, dust, and unsteady conditions are avoided.

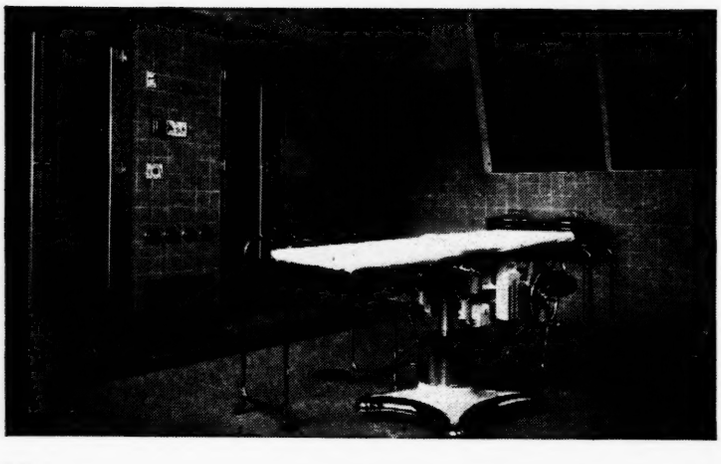
Does your hospital have air conditioning? Would you like to get literature on the subject? Write to

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

The Detroit Osteopathic Hospital Uses Frick Air Conditioning in this Operating Room



Ernest E. Dubry has been appointed superintendent of the central heating department of **The Detroit Edison Company** to succeed **J. Herbert Walker,** who was recently elected a vice-president. Other changes in the central heating department are the appointment of **Rudolph G. Felger** as assistant superintendent in charge of plants and coaling stations, and **Glenn D. Winans** as assistant superintendent in charge of steam distribution and customer relations. All three men have had many years experience in the central heating department of Detroit Edison and are registered engineers in Michigan.

Ernest E. Dubry

Glenn D. Winans

Rudolph G. Felger

Mr. Dubry came to Detroit Edison after graduating from the University of Michigan. He served in the navy from the day war was declared in 1917 to 1918, and prior to his appointment as assistant superintendent in 1922, was combustion engineer and assistant plant engineer at the company's power plants. He is a past president of the National District Heating Association and of the Michigan chapter of the ASHVE.

Mr. Felger started his work with Detroit Edison, after graduating from the University of Michigan, as a fireman at the Conners Creek power plant. After a year of military service he returned to the company as combustion engineer and later was made technical engineer. In 1929 he became assistant engineer of central heating.

Mr. Winans came to the Detroit Edison in 1921, a graduate from Ohio Northern University. He is a member of the Council of the ASHVE and a past president of the Michigan chapter, and has likewise been an active member and past president of the National District Heating Association. Before his new appointment Mr. Winans was distribution engineer of the central heating department.

Major William D. Antrim has returned to the **Bryant Heater Company** after nearly two years of service with the United States Army Ordnance Department. Mr. Antrim will devote his time exclusively to the adaptation of the new Bryant automatic safety pilot to gas range ovens and broilers.

William D. Antrim

A native of Philadelphia, Mr. Antrim attended Drexel Institute and, prior to his military service, was engaged in research and development on controls for Bryant Heater Company. Previously, he was associated for 17 years with the Roberts and Mander Stove Company as chief engineer.

The name of the **Steel Heating Boiler Institute, Inc.,** has been officially changed to **Steel Boiler Institute, Inc.** The nation-wide membership of the Steel Boiler Institute, Inc. includes manufacturers of various types of steel heating and power boilers. For some time it has been thought that the use of the word "heating" in the name implied restrictions on the products of the manufacturers which do not exist, because members of the institute manufacture steel boilers for both low pressure heating and high pressure power and process use.

Alfred Kauffmann, retired president of Link Belt Company, was elected a director of the **Gardner-Denver Company** at the annual stockholders' meeting held in the company's Quincy offices March 27. Mr. Kauffmann succeeds P. H. Gardner, who has resigned his directorship, because of ill health.

Establishment of the air conditioning department as one of the six major operating departments of the **General Electric Company** is announced. Operations pertaining to heating, air conditioning, and commercial refrigeration have previously been the responsibility of the company's appliance and merchandise department. The new department will have its headquarters at Bloomfield, N. J., and **George R. Prout** has been designated as general manager.

George R. Prout

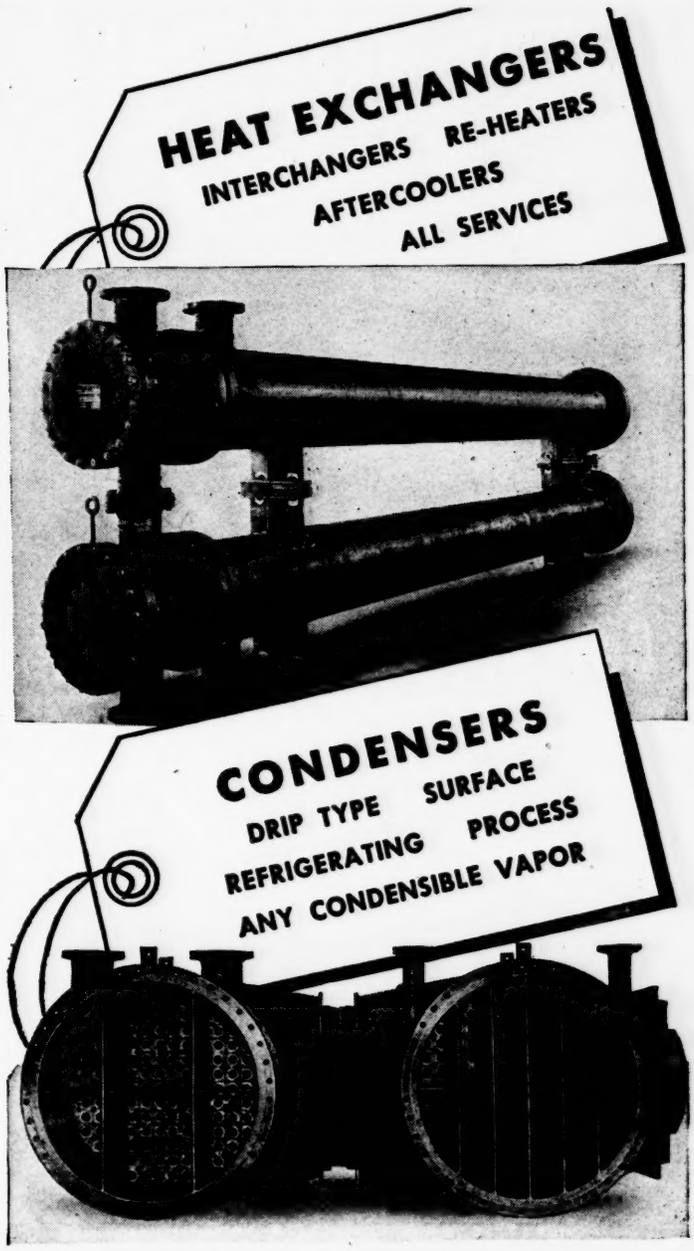
Mr. Prout, a graduate of Massachusetts Institute of Technology, has been connected with G. E. since 1920. Subsequently he represented the company in New England and in the southwest, and in 1939 was appointed manager of the industrial department for the entire southwest district. In 1941 he became manager of the industrial control division, with headquarters in Schenectady, and in 1944 was assigned to manage the air conditioning and commercial refrigeration activities in Bloomfield.

The new department will select and utilize appropriate marketing channels and methods for all of its products except air conditioning for rail transportation, which remains a responsibility of the transportation divisions of the company.

Carrier Corp., Syracuse, N. Y., has been awarded an "Approved" Quality Control Rating by Headquarters, Eastern District, Air Technical Service Command, Army Air Forces. This rating indicates exceptional efficiency of inspection personnel and procedure on Army Air Forces contracts undertaken by Carrier Corp."

Kieley & Mueller, Inc., North Bergen, N. J., has appointed **Jno. D. Hiles Co.,** Plaza Building, Pittsburgh, Pa., as agents in that area.

The **Viking Air Conditioning Corp.,** 5600 Walworth Ave., Cleveland, has enlarged its plant facilities by adding another floor to its building and occupying an adjacent building. The new building houses new and heavy presses which were installed for the manufacturing of invasion pipe clamps for the armed forces. These presses will be convertible to Viking's post-war operations in the manufacturing of blowers, humidifiers, attic and industrial fans. Much of the plant equipment, now used exclusively for war work, will be arranged to permit automatic assembly-line production when conditions again return to normal.



SYNONYMOUS TERMS { **Heat Transfer Equipment** / **PATTERSON-KELLEY**

Patterson-Kelley is an *engineering* as well as a manufacturing organization, designing heat transfer units of many types to customers' requirements. We bring to the problem of heat transfer a thorough understanding of its underlying principles.

If your designs with specifications are available, we will be pleased to quote. However, if the equipment is only in the planning stage, the benefits of our experience in thermal or mechanical design are yours for the asking.

EST. 1830

THE PATTERSON-KELLEY Company, Inc.

Main Office and Factory

107 WARREN STREET, EAST STROUDSBURG, PA.

BOSTON 16, 96-A Huntington Avenue • NEW YORK 17, 101 Park Avenue

PHILADELPHIA 3, 1700 Walnut Street • CHICAGO 4, Railway Exchange Building

REPRESENTATIVES IN ALL PRINCIPAL CITIES

RESEARCH AIR FILTERS

For Filter Banks and Industrial Dust Collection

HIGH DUST REMOVAL EFFICIENCY—because the air is reversed 21 times in its journey through the Research Air Filter—impinging on more than 30,000 tiny baffles per square foot. LOW RESISTANCE TO AIR FLOW—surface clogging reduced to a minimum.

Write For This Study

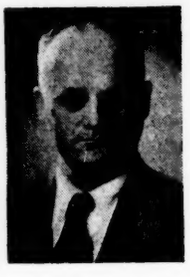
"The Effect Of Dirty Air Filters On The Performance of A Winter Air Conditioning Unit" —shows how clean filters cut heating costs, increases air volume circulation. Sent free on request, together with technical data sheets. Write today!

RESEARCH PRODUCTS CORP.
MADISON 3, WIS.

National headquarters offices of **The American Society of Refrigerating Engineers,** for the past three years located at 50 West 40th St., New York City, were moved on April 15 to 40 West 40th Street, next door to the old location. New furnishings have been acquired for the attractive new suite, on the 12th floor of the American Radiator Company's skyscraper.

A priority has been given to **The Herman Nelson Corporation,** manufacturer of heating and ventilating equipment, by WPB for erection of a 51,000 square foot addition to one of its plants in Moline, Ill. Other plants are located in East Moline and Chicago, Illinois.

Samuel J. Gates, Parker A. Moe and **Robert H. Weiss** have announced the formation of an engineering firm under the name of **Gates, Moe and Weiss** at 611 N. Broadway, Milwaukee 2, Wis. Mr. Gates, a graduate of engineering of Syracuse University, has been engaged



Parker A. Moe

Robert H. Weiss

Samuel J. Gates

in private practice as an engineer for more than twenty years, principally in the field of steam, power and water supply for industry. Mr. Weiss, from 1925 to 1942 was employed in the plant engineering department of International Harvester Co. and since 1942 with Albert Kahn Associated Architects and Engineers on design of structural enclosures and power plants for war industries. Mr. Moe has been chief engineer of power for International Harvester Co. for the past fifteen years and prior to that was chief engineer of the Schroeder Hotel, Milwaukee, and The Oscar Mayer Packing Co. at Madison.

J. E. N. Hume, commercial vice-president and manager of the industrial divisions, and **J. W. Belanger,** manager of the Federal and marine divisions, have been named assistant managers of sales of the apparatus department of **General Electric Co.** effective April 9.

The name of **Surface Combustion** has been changed to **Surface Combustion Corp.** This change will not affect in any way the corporation's present organization and method of operation.

G. Edw. Porter, supervisor of tool equipment, **General Electric Co.,** Erie, Pa., is retiring after 34 years with that company and will be located at his home at 100 N.E. 104 St., Miami, Fla.

Fred C. Boyce, Wauwatosa, Wis., was re-elected president of the **D. J. Murray Manufacturing Co.,** Wausau, Wis., at the company's annual meeting. Other officers elected are: M. P. McCullough, Chicago, vice-president; C. E. Staky, Wausau, executive vice-president and general manager; A. W. Plier, Wausau, secretary; and J. S. Alexander, Wausau, treasurer.

Harvey-Whipple, Inc., Springfield, Mass., has appointed **James Matthew** to its advertising staff. Prior to joining Harvey-Whipple he was engaged in Government work in the aviation field.

John H. Seippel, formerly general manager of Hoffman Specialty Company, and before that merchandise manager of the heating and plumbing division of Montgomery Ward, has joined **Climax Industries** as vice-president. Mr. Seippel will make his headquarters in Chicago at the Civic Opera Building, owned by Climax interests.

John H. Seippel

Companies in the Climax Industries group include Climax Engineering Company, makers of gas, gasoline and Diesel engines and generating sets; McAlear Mfg. Company, makers of automatic and temperature controls, diaphragm valves and heating specialties; Hanlon-Waters, producers of flexible lock couplings, control regulators, oil and gas separators, steel tanks, etc.

P. R. Mork has been elected executive vice-president of **Crane Co.**, Chicago, and **J. A. Dwyer**, vice-president in charge of sales. Mr. Mork started in the warehouse at the Minneapolis branch in 1901 and filled many positions up to assistant to the manager before being transferred to the Duluth branch as manager in 1911. From 1924 to 1927 he managed the Minneapolis branch and was then promoted to manager of the New York branch, being made vice-president 4 years later. In 1934 he came to the general office, Chicago, as vice-president in charge of sales, and since 1941 has been a director of the company. As executive vice-president he will act for the president in his absence. The sales and branch house, the purchasing and the engineering and research divisions will report directly to him and he will cooperate in functional matters with the finance and manufacturing divisions. Mr. Dwyer, who succeeds Mr. Mork as vice-president in charge of sales and branch houses, has also come up through the ranks. Starting in Philadelphia in 1917, he was scarcely settled when World War I called him into military service. When he returned from France in 1919 he went back to the Crane branch in Philadelphia and was successively estimator, salesman, chief clerk, sales manager, assistant branch manager and, in 1935, manager. He was promoted to district manager in 1937, brought to Chicago as manager of branch houses in 1943, and in January, 1944, was made general manager of sales and branches.

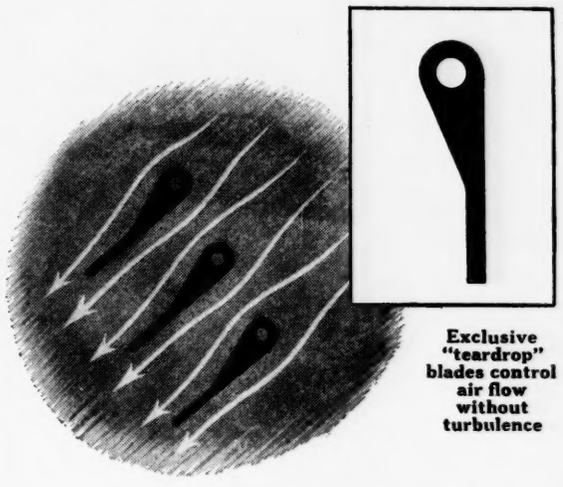
L. H. Fischer has been appointed Cincinnati district engineer for **The Vilter Mfg. Company.** Mr. Fischer will be in charge of the Vilter branch office in the Ingalls Bldg., Cincinnati. His territory will include the southern Ohio, Kentucky and parts of West Virginia and Indiana. He has been connected with the refrigeration and air conditioning industry in various sales and engineering capacities since 1925. Prior to opening the Cincinnati office he spent some time at the Vilter plant in Milwaukee.

L. H. Fischer

Donald S. Woods has been placed in charge of sales of the Evanair furnace and water heater section of the **Evans Products Co.** Mr. Woods comes to the Evans organization from WPB where he was chief of the plumbing and heating branch of the Office of Civilian Requirements. Prior to that he was with the National Housing Agency and American Radiator & Standard Sanitary Corporation.

B. R. Gale Company has moved its offices to 338 Newbury St., Boston 15, Massachusetts.

Quiet as a Whisper



Exclusive "teardrop" blades control air flow without turbulence

streamlined BLADES handle high-velocity air without grille noise

In buildings where air distribution requires high velocities, the modern answer is

Waterloo AIR DIFFUSERS

The exclusive STREAMLINED blades on Waterloo registers and grilles direct the flow of air without noise or turbulence. And because each blade is individually adjustable, the air flow can be channeled in 1-2-3 or 4 directions at the same time—to fit the individual requirements of each room. Definite advantages, that make it worth while to specify Waterloo. And, post-war, Waterloo "grilles of the future" will be still further ahead of the parade.

Waterloo REGISTER CO.

Established 1902

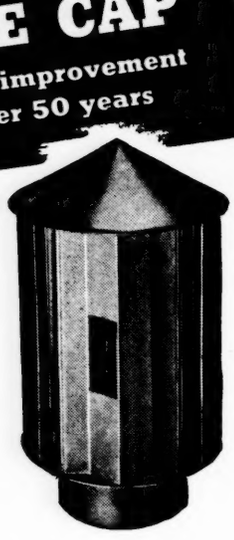
Waterloo, Iowa Seattle, Wash.

Representatives in all principal cities

Positive Ventilation *without Down-Draft!*

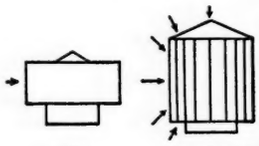
Breidert Air-X-Hauster VENT FLUE CAP

The greatest scientific improvement in Ventilators in over 50 years



Ends annoyance and danger of pilot lights blown out by down-drafts.

No matter which way the wind blows, the revolutionary, aerodynamically correct design of the Breidert Air-X-Hauster enables it to provide safe, sure ventilation. No moving parts . . . "back-draft" eliminated where no interior negative pressure exists! • Unlike conventional ventilators, the Breidert has been thoroughly tested (by Smith, Emery & Co., Pacific Coast branch, Pittsburgh Testing Laboratories) with wind blowing at *all* angles, and its capacities *certified.*

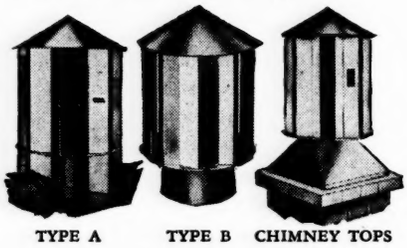


Old Method **Breidert Method**

THE ANSWER TO GAS HEATER PROBLEMS . . . The Breidert does not have the defects of conventional types of caps and accessories. It eliminates the necessity for down-draft diverters, with accompanying dangers of explosion in case unburned gas accumulates or is blown into the room.

Breidert Air-X-Hausters for Roofs and Chimney Tops

There is a Breidert Air-X-Hauster for practically every home, commercial and industrial ventilating problem. Thousands are successfully in use in all parts of the country.



TYPE A TYPE B CHIMNEY TOPS

WRITE FOR FREE ENGINEERING DATA BOOK . . . contains specifications and installation data, certified capacity ratings, etc. Address Dept. R

G. C. BREIDERT CO.

634 South Spring Street, Los Angeles 14, California

REPRESENTATIVES LOCATED IN PRINCIPAL CITIES OF THE U. S.

L. C. Hart of New York, vice-president of the Johns-Manville Sales Corp., was elected president of the **Producers' Council,** national organization of manufacturers of building materials and equipment, at its annual meeting in April. **Tyler S. Rogers,** Owens-Corning Fiberglas Co., Toledo, was chosen first vice-president, and Gordon C. Hay, Fiat Metal Mfg. Co., Chicago, was re-elected second vice-president. **Frank A. Sansom,** Chamberlin Co. of America, Detroit, continues as secretary of the Council, and **Allen E. Pearce,** Armstrong Cork Co., Lancaster, Pa., was named treasurer.

Establishment of **B. F. Goodrich Chemical Company,** a division of The B. F. Goodrich Company, with offices and laboratories in Cleveland, and manufacturing plants in Ohio, New York, and Kentucky, is announced. B. F. Goodrich Chemical Company is engaged in the manufacture and sale of the company's line of Geon vinyl resins, chemicals, and synthetic and reclaim rubbers. **William S. Richardson,** with B. F. Goodrich since 1926, is president of the chemical company. B. F. Goodrich Chemical Company offices and service laboratories are located in the Rose Building, Prospect Avenue and East Ninth St., Cleveland.

William Wagner has been appointed New York district sales manager for **Reading-Pratt & Cady Division of American Chain & Cable Company, Inc.,** with headquarters at 230 Park Avenue, New York City. Mr. Wagner has been with the Reading-Pratt & Cady sales department for 25 years. He succeeds **E. Coit Magens,** now manager of the valve division, American Chain & Cable Company export department.

C. E. Mason has been appointed technical director of the **Bristol Company,** Waterbury 91, Conn., with headquarters at the general offices of the company at Waterbury.

WHAT READERS SAY

Radiant Heating

EDITOR, HEATING AND VENTILATING:

The press of other work has delayed my answering the comment by R. G. Vanderweil which appeared in your February issue on my recent article in HEATING AND VENTILATING.

I agree with Mr. Vanderweil on all the comments which he has made with the reservation that they are more applicable to domestic installations than to the large industrial type of building. My article was not clear on this point as I had in mind large space industrial applications rather than the smaller domestic type, but did not so state.

While it is very true that all of the limitations which he mentioned occur in domestic installation with low ceilings where re-radiation from floor to walls to ceilings, etc., is possible, the situation is quite different in an industrial application where the ceiling is often fifty feet above the floor. On such installation, it has been experienced several times that it has been possible to obtain a greatly increased output by an increase in the incoming water temperature with only a negligible change in the floor surface temperature.

The largest installation which I have designed to date contains 136,000 sq ft of panel heated floor surface and I have very exhaustive test data on this system covering a period of three years which I hope to correlate into some definite formulae as soon as time permits.

Denver, Colo. *Elmo Hall, Consulting Engineer.*

"Freon" Charts

Mollier Heat Charts for the refrigerants "Freon-12" (in the low temperature region), "Freon-22", and "Freon-114", printed in five colors on extra heavy paper and each measuring 24 x 18½ in., have just appeared. Following the Mollier pattern, lines of constant entropy, constant temperature and constant volume are plotted on a grid of heat content versus absolute pressure. Identical charts for "Freon-11", "Freon-12", "Freon-21" and "Freon-113" have previously appeared. All are available on request.—*Kinetic Chemicals, Inc., Wilmington 98, Del.*

Tabasco Heater

Punched illustrated folder (TW-95d) to present the steel welded hot water heaters. Catalog GW-95a describes a garbage burner to heat 165 to 700 gallons of water 50 degrees per hour.—*Kewanee Boiler Corp., Kewanee, Ill.*

Damper Control

A 4-page, standard size, loose-leaf-punched catalog describing and illustrating the company's line of damper regulators, remote controls, dampers and by-pass dampers.—*The Young Regulator Co., 5209 Euclid Ave., Cleveland 3, Ohio.*

Axial Flow Fans

Illustrated folder to describe the various models of Propellair axial-flow fans.—*Propellair, Inc., Springfield, Ohio.*

Heat Transfer Equipment

Bulletin 645 of 15 illustrated pages describes heat transfer equipment including shell and tube, and coil types.—*The Whitlock Manufacturing Co., 48 South St., Elmwood, Hartford 1, Conn.*

Blast Freezing of Foods

A 16-page illustrated brochure on "Blast Freezing of Foods" presents detailed descriptions of Carrier's standards units, suspended blast freezers, floor-mounted blast freezers, freezing systems for special needs, refrigeration machines, and evaporative condensers.—*Advertising and Sales Promotion Department, Carrier Corporation, Syracuse 1, N. Y.*

Make-Up Valves

Data Sheet 420-IND-1 of two standard size, loose leaf punched pages, shows recommended piping arrangement for the company's make-up valves.—*American-Marsh Pumps, Inc., Battle Creek, Michigan.*

Adhesives

Cements for natural and synthetic rubber are described in a special 12-page bulletin. Directions for the application of the adhesives are included. Data are given on cement weights, colors and base materials.—*The B. F. Goodrich Co., Akron, Ohio.*

Welding Ideas

Within a 20-page bulletin are "101 Welding Ideas for Low-cost Maintenance," and many illustrations to show pictorially some of the results achieved.—*The Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.*

AUTO-LITE *Indicating Thermometer Model F-1 $20.*

Shown with capillary tubing for remote reading.

You Benefit 4 Ways with AUTO-LITE INDICATING THERMOMETERS

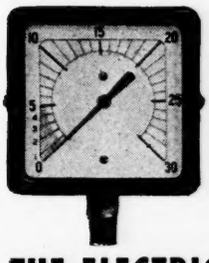
1. Absolute accuracy of temperature indication...

2. No intricate mechanism to get out-of-order...

3. Low cost of instruments due to specialization and large-scale production...

4. Remote reading—temperature observation can be made at some distance from where temperatures are taken. This aids in maintaining systematic temperature observations.

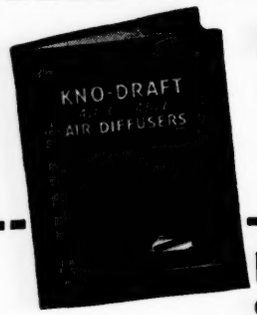
These four features recommend AUTO-LITE *Indicating Thermometers for use wherever uniform temperature is required in heating or cooling. Write for full information on this money-saving, time-saving temperature indication.*



Illustrated at left is a square case pressure gauge, standard pressure ranges up to 500 pounds. This is one of many types of precision measuring instruments made by us for specific industrial applications.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
CHRYSLER BUILDING, NEW YORK 17, N. Y.

In addition to a wide range of thermometers and gauges, we specialize in the production of instruments of special design for use as a standard part of manufacturers' equipment. Ask us for recommendations for your postwar needs.



NEW HANDBOOK
SIMPLIFIES SELECTION AND APPLICATION OF AIR DIFFUSERS

FREE: To those responsible for air diffusion "design."

And to those who install the equipment and are responsible for its performance.

FREE: New Engineering Data on the art of Air Diffusion in general and the proper application of KNO-DRAFT *ADJUSTABLE* DIFFUSERS in particular.

Performance Data
Selection Charts
Air Capacity Tables with instruction sheets
Damper Setting Chart
Air Direction Adjustment Chart
Standard Specifications
Complete Price List

IT CONTAINS clear sketches, charts, dimension prints and instructive text for quick, accurate SELECTION – APPLICATION – LOCATION – ASSEMBLY – ERECTION – TESTING –ADJUSTMENT of air diffusers and of ACCESSORY EQUIPMENT such as dampers, air equalizing grids, mounting rings and air sectorizing baffles.

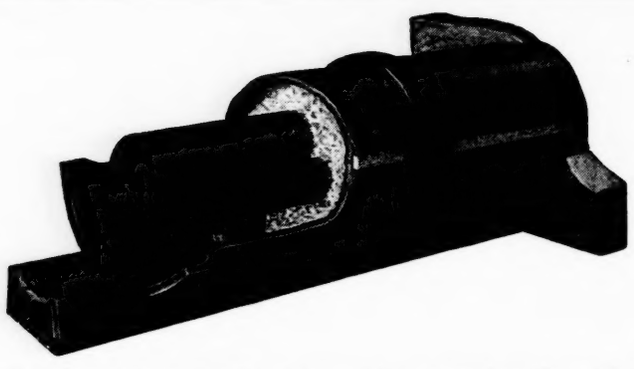
All set up in durable loose-leaf binder to facilitate the insertion of supplementary or revised data which will be forwarded from time to time to those who have sent for this catalog. Write for your free copy to Department E-3.

W. B. CONNOR ENGINEERING CORP.

114 E. 32nd Street — **New York 16, N. Y.**

WB CONNOR

Write for Quotation on
ADSCO-BANNON TILE CONDUIT
with Fiberglas Insulation



Made of vitrified clay tile, insulated with "Fiberglas" insulation, it is a combination that can't be topped for permanency or efficiency. Write for quotation giving length of line, size of one or more pipes, steam pressure and temperature — or for further information ask for Bulletin No. 35-67 HV.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA N. Y.
Makers of UP TO-DATE Steam Line Equipment For Over 65 Years

Compressors

Bulletin C-1100-B20, 14 illustrated pages, describes a line of electric driven refrigeration compressors; bulletin C-1100-B26 on type VSA, size 5 x 5 in., vertical, two-cylinder, single acting refrigeration compressor; bulletin C-1100-B18A on type VSA, 8 x 8 in., 9 x 9 in., and 10 x 10 in., vertical, two-cylinder, single acting enclosed refrigeration compressors; bulletin C-1100-B19A on type VSA, 6 x 6 in., and 7 x 7 in., two-cylinder, single acting enclosed refrigeration compressors; bulletin C-1100-B11A on type VSA, 3x3 in., and 4x4 in., two cylinder, single acting enclosed refrigeration compressors.—*Worthington Pump and Machinery Corp., Harrison, N. J.*

Feed Water Heaters

Bulletin treating on open feed water heaters of various types. Publication 4091 illustrates and describes different types of tray heaters for various applications, the jet heater, V-notch metering heater, also the convertible tray type of heater, which by the insertion of additional trays can be converted into a deaerator.—*Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, Pa.*

Safety Clamps

Illustrated folder to describe and illustrate a new method of banding hose or splicing cable. Two types of clamps are available.—*Industrial Products Sales Division, B. F. Goodrich Co., Akron, Ohio.*

Switches

A 14-page loose leaf folder covering the company's line of snap action switches and including an explanation of the principle, together with general specifications, illustrations, size and capacity data for the line.—*Acro Electric Co., Cleveland, Ohio.*

Automatic Shaft Seals

Spiral bound catalogue, file folder size, which describes and illustrates the company's line of standard automatic shaft seals.—*Schwitzer-Cummins Co., 1123 Massachusetts Ave., Indianapolis 7, Ind.*

Automatic Defrosting

Bulletin TV-345-B, an illustrated folder, describes the Thermobank for conventional refrigeration systems. It makes possible an automatic self-defrosting system utilizing some of the heat from the compressor discharge.—*Kramer Trenton Co., Trenton 5, N. J.*

Metal Hose

A 60-page manual on installation of flexible metal hose, with over sixty pages of photographs, specifications and line drawings. Sections are devoted to showing photographically how to assemble detachable self-sealing hose couplings and self-flaring fittings for copper and plastic tubing right at the job, thus effecting important savings.—*Packless Metal Products Corp., New Rochelle, N. Y.*

Piping

Fluid Handling Equipment catalog No. 45, describing the company's line of devices for the protection of operating equipment connected with the piping systems utilized in industrial, processing and power plants. Features a complete line of suction and pressure line fittings such as duplex vertical and horizontal chamber type strainers, Y-strainers, angle type strainers, 90° offset pressure and 180° straight-through pressure strainers, and remote valve control assemblies. Other products described are grease interceptors, vents, valves and drains.—*J. A. Zurn Mfg. Co., Erie, Pa.*

Lap Flaring Machine

Illustrated folder presents the details of the Leonard Model DF Tube Master for producing a double thickness of metal on flange of flares. No hand tools are required. Machine is for non-ferrous tubing from ⅛ to ½ in.—*Leonard Precision Products Co., 1100 Larson Ave., Garden Grove, Calif.*

Air Control

Illustrated folder describing an air control for shallow well pumps. Control is for applications up to 80 lb per sq in. tank pressure.—*Electro-Mechanical Division, Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn.*

Boiler Water Treatment

Bulletin 451, a 4-page folder, describes a boiler water treatment to prevent scale, control alkalinity, remove dissolved oxygen, and a protection against corrosion and pitting. "Packaged" chemical feed systems are available.—*Milton Roy Pumps, 1300 E. Mermaid Ave., Chestnut Hill, Philadelphia 18, Pa.*

Electric Timer

Illustrated bulletin 1100 describes stop clocks and chronoscopes, combination timers and impulse counters, and spring wound X-ray timers. Circuit diagrams are included.—*C. H. Stoelting Co., 424 N. Homan Ave., Chicago 24, Ill.*

Black Line Prints

A standard size, 28-page catalog entitled "It's Positively Right in Bruning Black and White," and devoted to the advantages and descriptions of the company's line of machines for making black and white black line prints as distinguished from blueprints.—*Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, Ill.*

Getting Personal

Allen D. Brandt

Allen D. Brandt (A Summary of Design Data for Exhaust Systems, page 73) was born in Pennsylvania and received his education at Penn State and Harvard. He attended Harvard on a Rockefeller Foundation Fellowship and received both the Master and Doctorate degrees in Sanitary Engineering.

Following the completion of his education in 1933 he became associated with Willson Products Incorporated, Reading, Pa., as director of Industrial Hygiene Research. In 1940 he received an appointment to the Commissioned Corps of the U. S. Public Health Service and was stationed at the National Institute of Health, Bethesda, Maryland, for 2½ years.

Early in 1941, Dr. Brandt was appointed Chief of the Engineering Unit in the Division of Industrial Hygiene of the Public Health Service which position he held until he was detailed to the Safety and Security Division of the Army in 1942. In this assignment, he is responsible for the over-all coordination and supervision of the industrial hygiene engineering phases of the industrial health program in all the Army-owned plants engaged in the manufacture, loading, and handling of explosives.

SHOPPERS IN STORE DETECT NO VIBRATION FROM COMPRESSORS ...KORFUND VIBRATION CONTROL

Although the two ammonia compressors required for air conditioning a large department store are installed on the fourth floor of the building, shoppers are not conscious of any noise or vibration. In fact, a disinterested party, asked if he could discover the location of the equipment by ear, was unable to do so from any of the store's shopping areas.

This is a typical example of an "impossible location" for heavy equipment made possible by Korfund. As shown in the photograph, the two compressors, arranged in duplex, are mounted on Korfund steel-spring isolators incorporated within a structural steel base. The isolators prevent the transmission of noise and vibration throughout the building structure.

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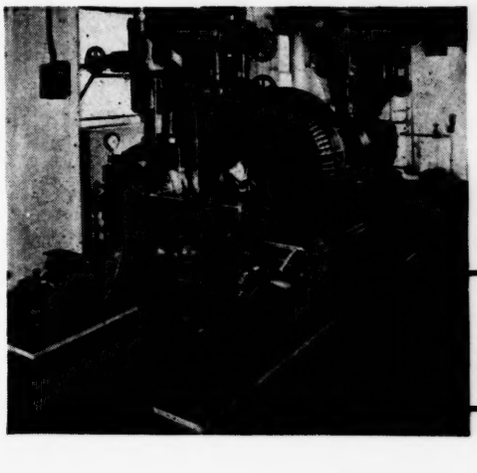
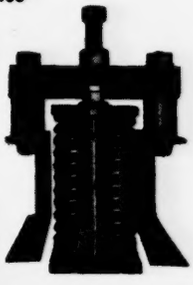
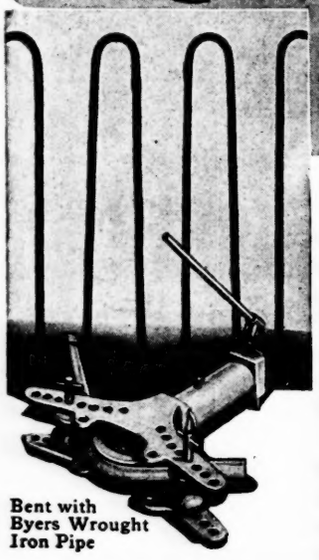




Left — The two compressors are installed on the fourth floor of the building. Above—Type of Korfund isolator used in this installation.

Bend Pipe On The Job Do it Quicker-Easier with Tal's Prestal Pipe Bender



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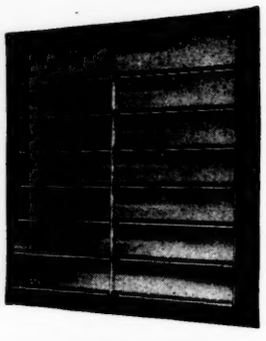

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INDUSTRIAL DEGREE-DAYS
March, 1945

City	55F Base	45F Base
Baltimore, Md.	140	18
Buffalo, N. Y.	363	157
Chicago, Ill.	234	79
Cleveland, Ohio	287	112
Detroit, Mich.	280	110
Indianapolis, Ind.	176	45
New York, N. Y.	220	67
Philadelphia, Pa.	177	41
Pittsburgh, Pa.	416	205
St. Louis, Mo.	150	41

Canadian Degree-Days for March, 1945

City	March 1945	March Normal	Cumulative, Sept. 1 to Mar. 31 1945	Cumulative, Sept. 1 to Mar. 31 Normal
Calgary, Alta.	1057	1215	6917	7881
Charlottetown, P. E. I.	1091	1203	6417	6869
Crescent Valley, B. C.	822	961	5813	6704
Edmonton, Alta.	1147	1293	7979	8608
Fort William, Ont.	1079	1386	8064	8590
Grand Prairie, Alta.	1234	1339	8303	8795
Halifax, N. S.	927	1066	5555	6205
London, Ont.	701	1073	6380	6326
Medicine Hat, Alta.	1011	1150	7350	7588
Moncton, N. B.	1097	1190	6935	7296
Montreal, P. Q.	877	1209	7258	7284
North Bay, Ont.	967	1280	7911	7933
Ottawa, Ont.	887	1256	7441	7638
Penticton, B. C.	840	787	5251	5566
Porquis Junction, Ont.	1091	1550	8952	9614
Prince George, B. C.	1042	1091	7315	7768
Quebec City, P. Q.	1011	1311	7303	7999
Regina, Sask.	1147	1504	8464	9641
St. John, N. B.	958	1132	6394	6784
Saskatoon, Sask.	1135	1415	8509	9356
Toronto, Ont.	691	1078	5924	6242
Vancouver, B. C.	701	682	4258	4479
Victoria, B. C.	648	651	3713	4065
Windsor, Ont.	601	995	5589	5872
Winnipeg, Man.	1104	1531	9383	9622

*These data are supplied through the courtesy of the Meteorological Division, Air Services Branch, Department of Transport, Canada, with the cooperation of N. W. Etter, Heating Engineer, Enamel & Heating Products Limited, Sackville, N. B.

The Department reports some slight revisions in the figures for February, as published in last month's issue. Corrected figures are: Calgary, Alta., 1305; Grande Prairie, Alta., 1481; Penticton, B. C., 865; Prince George, B. C., 1193; and Quebec City, P. Q., 1302.

ALL FOR WANT OF A PRV

(Continued from page 97)

good. As an example of the latter, a runout to a steam riser was laid in the cement floor of the small downstairs toilet where the writer would never have allowed it had he been around when this was being done, and now would never allow it to be removed, since its hot panel effect is very "comfy" on a couple of bare feet in the morning.

Another example of this point is the noise from the one-pipe steam heating system. The house has a low noise level, due to surrounding estates and absence of streets. Because the oil burner is too good the boiler has a rapid pick up, and the system has some very fast air reliefs, the expansion of the pipes is most rapid. Accordingly, a great deal of con-

densation also takes place in a given time, especially so after a night set-back or a long lay-off. Neither does it take much steam or condensation to quickly occupy the small volumetric displacement of the concealed copper radiators.

So in this heating system there are certain noises, some water-borne, some where pipes groan on wood or hang on and finally reluctantly let go, and some where sheet metal fronts of large radiator enclosures expand and buckle. True, that suitable provision for expansion of runouts from main to risers would help, but the point is that these runout arrangements are good enough if the pick up of the system were less rapid. Steam was formerly in the radiators within 15 minutes after a night set-back; now with a smaller oil burner nozzle the pick up is still rapid, about 20 minutes. Anyhow, much less oil is consumed due to the use of the smaller nozzle. The job was put in too good, the plumber was — — good.

YOUR MERCHANT MARINE

(Concluded from page 63)

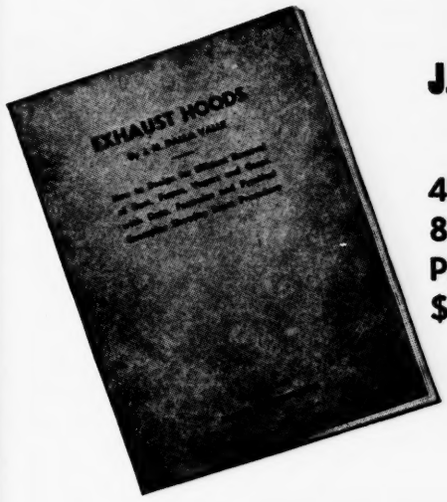
comfort air conditioning. Unfortunately, the additional maintenance required by the cooling equipment makes space consideration an even greater problem. Also, no large passenger vessel has ever been built which provided air filters for all living and commissary spaces. The addition of this equipment, therefore, will increase the amount of equipment space required.

Ships are so cut up by watertight subdivisions that the air handling systems are relatively small. For this reason, primary air systems do not offer the same advantages as they are supposed to have on land. The trouble in the past has usually been that little or no provisions were made in the basic design of the ship for the ventilating and heating equipment. Space limitations should not be misconstrued as a lack of space. In most instances, space can be made available if it is requested at the time a ship's design is fluid. It is true that large size horizontal ducts are invariably impractical. Nevertheless, in numerous cases, the deck heights have been increased 6 inches or even 12 inches to provide adequate headroom beneath ducts, piping, and wireways.

A well-designed ship neither wastes space, nor carries a large amount of unnecessary weight around, particularly above the waterline. Nevertheless, the naval architect must be aware that the air conditioning engineer requires space to do his job. It is, therefore, essential that the latter study his problem thoroughly and determine his space requirements intelligently.

A true comparison of the space, cost, and weight requirements for various types of air conditioning systems should not only consider the central air handling equipment and distributing ducts, but also the piping, valves, insulation, secondary conditioning units, grilles, controls, and other essential parts. All too frequently only the air handling equipment has been compared, and, as a result, erroneous conclusions have been drawn

EXHAUST HOODS



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